FOUNDRY

EST. 1902 TRADE JOURNAL

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 100
No. 2066
Registered at the G.P.O. as a Newspaper

APRIL 5, 1956
Offices: John Adam House, John Adam St., London, W.C.2

Single Copy, 9d. By post 11d. Annual Subscription, Home 40/-, Abroad 45/- (Prepaid)

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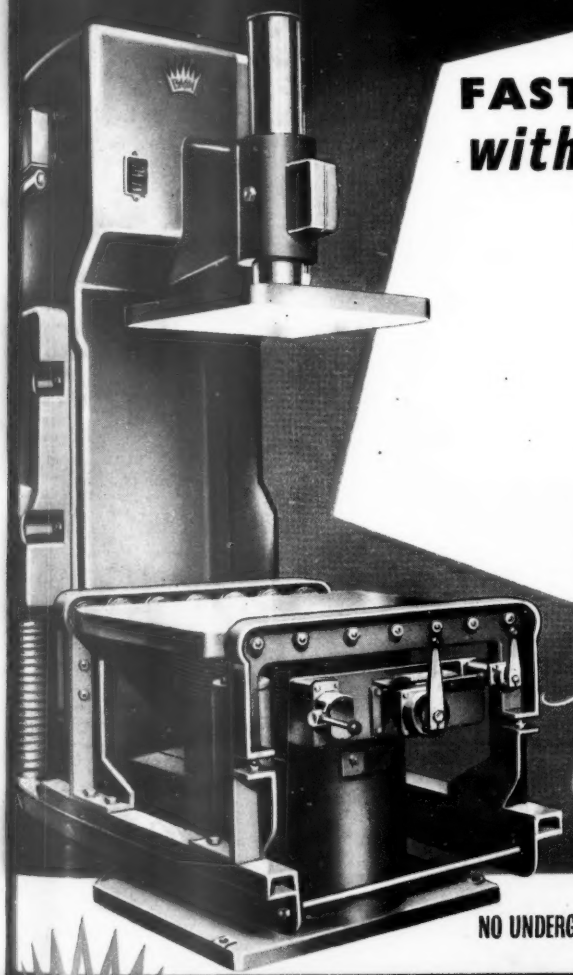

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FOUNDRY TRADE JOURNAL

Established 1902

Vol. 100 Thursday, April 5, 1956 No. 2060

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AN INDUSTRIAL NEWSPAPERS PUBLICATION

Published Weekly

Single copy 9d.; by post 11d.;
Annual subscription: home 40s., abroad 45s. (prepaid).

17/19 JOHN ADAM STREET, ADELPHI, LONDON, W.C.2

'Phone: TRAfalgar 6171 (10 lines)
'Grams: Zacatecas, Rand, London.

Catching Up

As we have been unable—owing to a dispute in the printing trade—to comment on current events, we are endeavouring, somewhat sketchily perhaps, to bring matters up-to-date. First there have been the 1955 production returns of the major sections of the foundry industry. Ironfounding, with a record production of 3,925,070 tons, was 4.9 per cent. greater than that of 1954. The last quarter made a particularly good showing, greatly influenced by increases of the order of 8,000 to 9,000 tons by the North West and Yorkshire regions. During the year, the labour force in this large section increased by 3,352 to 146,103 persons. The steelfoundry section, with a production of 312,142 tons (as against 296,400 tons in 1954) made a slightly better showing, *i.e.*, 5.3 per cent. Still better results were recorded by the light-alloy section where the output of aluminium-alloy castings rose from 80,836 tons in 1954 to 90,206 tons last year—an increase of 11.5 per cent. The best figures, however, came from the brass and bronze founders where production rose from 60,930 tons in 1954 to 72,072 tons last year. This increase was of the order of 18 per cent. These percentages ranging from 4.9 to 18 are indeed illuminating and would indicate that the ferrous metals are lagging behind in the production race as measured by weight of output.

The vexed question of restrictive practices has been very much to the fore during the last few weeks. On the first reading of the Bill dealing with this subject—"Restrictive" Trade Practices Bill—we cordially approved of the notion of having a judicial tribunal to assess the merits of any individual case, but after reading the statement made by the Federation of British Industries and other bodies, it does appear that such an idea cuts across the basic notion that a person is presumed to be innocent until guilt is proved. Moreover, the Registrar's powers are cast too wide, as they include, in some circumstances, the right of entry and search without a Court warrant. The proposed legislation, however, would only have repercussions on a small section of the foundry industry as a whole.

Another important event which has occurred is the Government proposal to reinforce the educational system of this country in the field of technology. For the first time in our recollection, definitions are given of technicians and technologists. Technical education is a vast pyramid and the object of the Government is to strengthen its base, leaving the apex for attention when an adequate supply of technicians and technologists has been created. Serious attempts are to be made to attract girls, as at present when they finish school they seldom indulge in further education to make themselves proficient in the

Catching Up

crafts to which they have been attracted. Many millions are to be spent in the extension of existing and the erection of new technical schools and colleges.

For the first time in history, the master patternmakers of two nations have been brought together. At the invitation of the *Chambre Syndicale des Patrons Modeleurs Mécaniciens de la Région Parisienne*, the National Society of Patternmakers spent a long week-end in Paris during which visits were paid to ten patternshops, a trade school, and the *Centre Technique des Industries de la Fonderie*. The school was probably the most important and interesting aspect of the tour, for hereat, after a four-year period of training, wooden patternmakers are so qualified that they are well capable of taking their places as skilled improvers in industrial establishments. The tour, which, happily, is to take effect in the reverse direction next year, was an outstanding success.

Much interest is being aroused by the CO_2 Process. A conference on the subject organized by the British Cast Iron Research Association attracted 250 people to London, with a further 50 excluded owing to lack of accommodation in the meeting room. A meeting held on the same day by the Association of Bronze and Brass Founders on this subject also attracted a large audience. It heard an abstract of a report by Mr. Rice of the British Non-Ferrous Metals Research Association and this programme is to be repeated in other areas. The views expressed at the two meetings in London were by no means unanimous as to the efficiency of the Process, but there was ample evidence that it is sufficiently promising to warrant energetic exploitation.

A word of explanation: Many readers have telephoned and written to the editorial office over the last few weeks asking what was happening to their copies of the JOURNAL. It was necessary to explain to them, and the facts are repeated here, that owing to a dispute in the printing industry, particularly prolonged in the London area, no publication of the JOURNAL was possible between February 16 and the present issue, and four issues prior to the stoppage were somewhat attenuated.

The publishers of the JOURNAL were not a party to the dispute and had no jurisdiction over those involved, but they are very conscious of and sincerely apologize for the disruption which was caused in the normal service to readers and advertisers. Especially is this explanation and apology tendered to that large contingent of overseas readers of the JOURNAL who may not have been aware of the conditions affecting printing in this country. Henceforward, it is hoped quickly to resume the publication of normal issues and in some measure recover lost ground.

Latest Foundry Statistics

Castings Output, 1955

The production of grey and malleable-iron castings for 1955 reached the total of 3,925,070 tons. The production of steel castings during January was running at the high weekly average of 6,200 tons; the corresponding figures for 1955 and 1938 were 6,000 and 2,700 tons.

According to the Ministry of Supply, the output of aluminium castings in 1955 was 90,206 tons—80,836 tons were made in 1954. The new figure includes 21,626 tons from sand moulds; 50,664 tons as gravity-die- and 17,916 tons as pressure-die-castings. The 1955 production of magnesium castings was 4,557 tons. As reported by the British Bureau of Non-Ferrous Metal Statistics the output of copper-base castings during January was 6,733 tons as against a revised figure of 5,844 tons in January, 1955. The output during 1955 was 72,072 tons. This figure shows an increase of 11,142 tons over 1954 and means that the industry has made over 18 per cent. more castings—a truly noteworthy increase. The figures for the last four years read 66,303; 50,093; 60,930 and now 72,072. Castings of pure copper also rose in 1955 from 6,000 to 6,450 tons.

Employment

The Council of Ironfoundry Associations announced that 146,103 ironfoundry workers were employed in the United Kingdom during the week ending December 31, 1955. Of these, 135,771 were males and 10,332 females. The corresponding figures for the week ending December 3, 1955, were 146,080 and January 1, 1955, 142,751. More-recent information from the Council states that 146,505 people were employed in iron foundries during the week ending January 28. This shows an increase of 1,983 as compared with a year previous. The increase of women employees during this latter period was 334. The monthly *Bulletin* of the Iron and Steel Board reports that there were 20,526 people employed in the steel foundries on December 10, 1955, which registered an increase of 144 as compared with a month earlier, and 679 in the case of a year earlier. Employment registered a decrease on January 7 of 240 as compared with December, but an increase of 590 during the year. In January it stood at 20,290.

Foremen's Training Course

For the Foundry Foremen's Training Course, organized by the Institute of British Foundrymen, being held at the Hotel Majestic, Harrogate, April 5 to 7, an unusually interesting series of lectures has been arranged. With the emphasis on practical subjects dealt with by practical "experts," there is much to benefit all who attend. Details of the programme are as follow:

Thursday, April 5: Registration from 4 p.m. onwards and a technical film display at 8.30 p.m.

Friday, April 6: Address by Dr. A. B. Everest, F.I.M. (president of the Institute), 9.15 a.m., followed at 9.30 a.m. by the "CO_2 Process," by A. Talbot; 11.10 a.m., "Looking after the Apprentice," by H. Haynes; 2 p.m., "Human Relations," by J. Holland; and group discussions of the day's subjects will be held at 8.30 p.m.

Saturday, April 7: 9.30 a.m., "Meeting the Customer's Requirements," by F. H. Greenwood; 11.10 a.m., "Servicing the Moulder," by H. Paton Millar. The Course will close with luncheon at 12.30 p.m.

Fifty-third IBF Annual Conference

Detailed Arrangements for the Cardiff Meeting, June 12 to 15

The fifty-third annual conference of the Institute of British Foundrymen will be held at Cardiff from June 12 to 15, inclusive. This year the conference is being organized by the Wales & Monmouth branch of the Institute, and Mr. H. J. V. Williams, past-president of that branch and a nephew of the late Mr. C. E. Williams who was a very highly esteemed national president of the Institute in 1933, will be installed in the office of president of the Institute during the conference. Cardiff is the capital city and one of the principal industrial centres of Wales. Its civic centre is unrivalled in the United Kingdom, and much beautiful country and many attractive coastal resorts lie within ready reach. The committee has therefore had an easy task in arranging, with the co-operation of the respective managements, a series of interesting visits to the important engineering works and foundries in the area, and a very attractive programme of visits and sightseeing excursions for the ladies.

Conference Office.—The conference office will be established on Tuesday, June 12, in the rooms of the South Wales Institute of Engineers, Park Place, Cardiff, and direction cards will indicate the location. Communications prior to this date should be addressed to the Institute's head office, St. John Street Chambers, Deansgate, Manchester, 3.

Programme

Tuesday, June 12:

Afternoon: Council and committee meetings at the Park Hotel, Park Place, off Queen Street, Cardiff. Open to Council and committee Members only, who will receive particulars later. Members and ladies make their own arrangements for luncheon and dinner.

7.15 p.m. to 12.00 p.m.: Reception by the Rt. Hon. the Lord Mayor of Cardiff and the Lady Mayoress at the City Hall, Cardiff. Musical programme followed by dancing. (Members and ladies; evening dress.)

Wednesday, June 13:

9.15 a.m.: Annual general meeting at the Park Hotel, Park Place, off Queen Street, Cardiff (members only). Presentation of awards.

10.45 a.m.: Adjourn for coffee. (members invitation.)

11.00 a.m.: Presidential address by H. J. V. Williams.

11.30 a.m.: Edward Williams Lecture entitled "Use of Castings in Modern Iron and Steel Plants," by W. F. Cartwright, D.L., J.P., M.I.Mech.E.

12.45 p.m. for 1.00 p.m.: Luncheon at the Park Hotel, Park Place, off Queen Street, Cardiff (members and ladies) (by invitation of the Wales and Monmouth branch).

2.30 p.m.: Technical sessions in the South Wales Institute of Engineers, Park Place, Cardiff.

7.00 p.m.: Reception at the City Hall, Cardiff, by the president and Mrs. Williams.

7.30 p.m. to 1.00 a.m.: Annual banquet in the City Hall, Cardiff, followed by dancing. (members, ladies and guests; evening dress.)

Thursday, June 14:

9.30 a.m.: Technical sessions in the South Wales Institute of Engineers, Park Place, Cardiff.

10.45 a.m.: Adjourn for coffee (by invitation).

12.45 p.m. for 1.00 p.m.: Luncheon at the Royal Hotel, St. Mary Street, Cardiff (members only).

2.30 p.m.: Technical sessions at the South Wales Institute of Engineers, Park Place, Cardiff.

Evening Entertainments.—Parties of members and ladies will visit one of the following:—Prince of Wales Theatre or New Theatre. Details of the attractions at these theatres during conference week are not yet known, but the Prince of Wales Theatre usually presents plays and the New Theatre revues or musical shows. For those who do not wish to visit the theatre a list of Cardiff's restaurants will be available at the conference office, as well as details of sailings to the Somerset Coast.

Friday, June 15:

Members will take part in one only of the following visits or groups of visits. Depart by motor coach from the car park at the Moat, Cardiff Castle, for:—

8.30 a.m.: (1) Morning. (*a*) Glanmor Foundry Company, Limited, Llanelly (iron and steel and roll founders); luncheon by kind invitation of Glanmor Foundry Company, Limited. Afternoon: (*b*) Richard Thomas & Baldwins, Limited, Landore (ingot moulds, general iron castings and silica bricks); tea by kind invitation of Richard Thomas & Baldwins, Limited, or

9.00 a.m.: (2) Morning. (*a*) Guest, Keen Iron & Steel Company, Limited, Dowlais (ingot moulds and general iron and non-ferrous castings); luncheon by kind invitation of Guest, Keen Iron & Steel Company, Limited. Afternoon: (*b*) Brown, Lenox & Company, Limited, Pontypridd (engineers, steel founders and chain makers); tea by kind invitation of Brown, Lenox & Company, Limited, or

9.05 a.m.: (3) Morning. (*a*) W. A. Baker & Company, Limited, Newport (engineers, iron, steel and non-ferrous founders—architectural and builders ironwork), and Goulds Foundries, Limited, Newport (mechanized and jobbing ironfounders); luncheon by kind invitation of Goulds Foundries, Limited. Afternoon: (*b*) Saunders Valve Company, Limited, Cwmbran (grey and malleable-iron castings for valves and pumps, etc.); tea by kind invitation of the Saunders Valve Company, Limited, or

9.10 a.m.: (4) Morning. (*a*) Northern Aluminium Company, Limited, Newport (remelting and alloying prior to casting for rolling, billeting or extrusion); luncheon at the St. Mellons County Club. Afternoon: (*b*) Dialoy, Limited, Colchester Avenue, Cardiff (die-casting foundry—pressure, gravity and sand castings); tea by kind invitation of Dialoy, Limited, or

9.15 a.m.: (5) Morning. (*a*) John Williams & Sons (Cardiff), Limited, East Moors Road, Cardiff (grey and alloy ironfounders, metal-window makers, etc.) and Dialoy, Limited, Colchester Avenue, Cardiff (die-casting foundry—pressure, gravity and sand castings); luncheon by kind invitation of John Williams & Sons (Cardiff), Limited. Afternoon: (*b*) B.S.A. Tools, Limited (Cardiff division), Curran Road, Cardiff (ironfounders); tea by kind invitation of B.S.A. Tools, Limited, or

9.20 a.m.: (6) (All-day). Steel Company of Wales,

Limited, Margam, Port Talbot (iron and steelmakers, tin plate and sheet manufacturers); luncheon by kind invitation of the Steel Company of Wales, Limited.

8.00 p.m. to 1.00 a.m.: Dinner/dance at the City Hall, Cardiff (members and ladies; evening dress preferred).

Ladies' Programme

Tuesday, June 12:

4.00 p.m.: Afternoon tea and informal reception by Mrs. H. J. V. Williams at the Angel Hotel, Westgate Street, Cardiff.

7.15 p.m. to 12.00 p.m.: Reception by the Rt. Hon. the Lord Mayor of Cardiff and the Lady Mayoress at the City Hall, Cardiff. Musical programme followed by dancing (members and ladies; evening dress).

Wednesday, June 13:

10.45 a.m.: Hairdressing demonstration by Mr. Tony Standish and Mr. Norman, respectively senior director of the provincial salons and director of the Cardiff salon of Raymond Art de Coiffure, Limited, in the Fashion Theatre at the premises of James Howell & Company, Limited, St. Mary Street, Cardiff. (Ladies make their own way to the Fashion Theatre.)

12.45 p.m.: Luncheon at the Park Hotel, Park Place, off Queen Street, Cardiff (members and ladies). (By kind invitation of the Wales and Monmouth branch.)

2.30 p.m.: Ladies will leave the Park Hotel on foot for one only of the following visits, both of which are within five minutes' walk of the hotel:—(1) Cardiff Castle, followed by tea at the Castle at 4.0 p.m., or (2) The National Museum of Wales, followed by tea at Cardiff Castle at 4.30 p.m.

7.00 p.m. to 1.00 a.m.: Annual banquet at the City Hall, Cardiff, followed by dancing (members, ladies and official guests; evening dress).

Thursday, June 14:

12.00 a.m.: Ladies leave by coach from the Car Park at the moat of Cardiff Castle at 12 noon for the St. Mellons County Club, St. Mellons, nr. Cardiff.

12.45 p.m.: Luncheon at the St. Mellons County Club.

Ladies may take part in one only of the following visits leaving from the St. Mellons County Club:—

1.45 p.m.: (1) Hoover (Washing Machines), Limited, Pentrebach, Merthyr Tydfil, Glamorgan; tea by kind invitation of Hoover (Washing Machines), Limited, or

1.45 p.m.: (2) Kayser Bondor, Limited, Pentrebach, Glam.; tea by kind invitation of Kayser Bondor, Limited, or

1.45 p.m.: (3) Coach tour of the Llangwm Hills and Tintern; tea at the Beaufort Hotel, Tintern. (Arrive Cardiff on return from all visits about 5.30 p.m.)

Evening entertainments: see general programme.

Friday, June 15:

9.45 a.m.: Ladies leave by coach from the Car Park at the moat of Cardiff Castle for Porthcawl *via* the coast road. Visit to St. Donats Castle, Llantwit Major, *en route* to Porthcawl. Arrive Porthcawl at 12.45 p.m.

Luncheon at the Esplanade Hotel, Porthcawl, at 1.0 p.m.

Leave Porthcawl at 2.30 p.m. for St. Fagans Castle, near Cardiff; tea at St. Fagans Castle; arrive Cardiff on return about 5.30 p.m.

8.00 p.m. to 1.0 a.m.: Dinner/dance at the City Hall, Cardiff (members and ladies; evening dress preferred).

Technical Papers

Wednesday, June 13:

2.30 p.m. to 5.30 p.m. Two simultaneous sessions.

Session A (Lecture Theatre, the South Wales Institute of Engineers, Park Place, Cardiff):—No. 1149, "Recent Developments and Current Trends of British Shell-moulding Practice," by D. F. Bailey (associate member); No. 1150, "Internal Stress" (report of sub-committee T.S.32 of the Technical Council); "Flow of Metal into Moulds" (film produced by sub-committee T.S.35 of the Technical Council).

Session B (Council Chamber of the South Wales Institute of Engineers, Park Place, Cardiff):—No. 1151, "Application of Insulated Feeders to Sand Castings in Long-freezing-range Copper Alloys," by R. S. Jackson, B.Sc., A.R.S.M. (British Non-Ferrous Metals Research Association paper); No. 1152, "Influence of Speed of Solidification on the Properties of Copper/Tin/Zinc and Copper/Tin/Phosphorus Alloys," by P. J. Le Thomas and D. Arnaud. (French exchange paper.)

Thursday, June 14:

9.30 a.m. to 12.30 p.m. Two simultaneous sessions.

Session C (Lecture Theatre, the South Wales Institute of Engineers, Park Place, Cardiff):—No. 1153, "Fundamental Considerations for Cupola Operation," by W. R. Jaeschke (exchange paper from the American Foundrymen's Society); No. 1154, "Cupola Experiments," by K. G. Harris, B.Sc., A.I.M. (associate member); No. 1155, "Shrinkage Defects in Grey-iron Castings," by I. C. H. Hughes, M.Sc., A.I.M. (associate member), and J. H. Gittus, B.Sc. (British Cast Iron Research Association paper).

Session D (Council Chamber of the South Wales Institute of Engineers, Park Place, Cardiff):—No. 1156, "Influence of Magnesium Content on Layer Porosity and Tensile Properties of Sand-cast Aluminium/magnesium Alloys," by R. Jay, B.Sc., A.I.M., and A. Cibula, M.A., A.I.M. (British Non-Ferrous Metals Research Association paper); No. 1157, "Solubility of Hydrogen in Iron/Carbon/Silicon Alloys," by T. Evans, B.Sc., A.R.I.C., F.Inst.F., and V. B. John, M.Sc.

2.30 p.m. to 5.0 p.m Two simultaneous sessions.

Session E (Lecture Theatre, The South Wales Institute of Engineers, Park Place, Cardiff):—No. 1158, "Development and Application of a Foundry Test for Assessing Shrinkage Behaviour in Grey Cast Iron," by J. Grice (associate member) and J. T. Berry, B.Sc., Ph.D. (associate member); No. 1159, "Receivers" (report of sub-committee T.S.44 of the Technical Council); No. 1160, "Emissions from the Cupola Melting Furnace," by F. M. Shaw, G.I.Mech.E. (British Cast Iron Research Association paper).

Session F (Council Chamber of the South Wales Institute of Engineers, Park Place, Cardiff):—No. 1161, "Chaplets and Internal Chills in Moulds for Steel Castings," by G. W. Miles, B.Sc. (Hons.) (Lond.), M.Met. (Sheff.), A.I.M.; No. 1162, "Steelmaking in Foundry Practice," by R. J. Sarjant, O.B.E., D.Sc. (member), and T. A. Cosh, B.Sc. (Met.), A.I.M. (associate member).

Applications for hotel accommodation should be made as soon as possible direct to the hotel and not to the Institute (with the exception of the St. Mellons County Club, which should be booked through the secretary) and in all cases the name of the Institute should be mentioned. It is desirable that all hotel accommodation be booked before May 12. A large proportion of the accommodation available consists of double- and twin-bedded rooms. Members who can share rooms with others, therefore, will assist greatly by doing so. The last day for receiving conference reply-forms (at the Manchester office of the Institute) is May 19.

Cast Manganese Steel

*By E. Piwowarsky and H. L. Roes**

[Slightly Abridged]

Production and metallurgy of cast manganese-steel is dealt with, including general properties; effect of individual elements, wall thickness and casting temperature; as-cast structure; determination of castability and heat-treatment. The Authors' tests are recorded, first on their initial melts then duplex melts and remelted charges discussing the effect of wall thickness and casting temperature and their relationship to grain size and, to some extent, carbide precipitation; followed by conversion of globular into dendritic-grain type at about 1,550 deg. C. Sections on the effect of heat-treatment; selection of lowest-possible casting temperatures, range of equal grain size in relation to temperature and wall thickness and proposals for further tests, conclude the Paper.

PRODUCTION AND METALLURGY

Since Hadfield's discovery in 1888 of austenitic manganese-steel with 12 to 14 per cent. Mn, it has found very wide application because of its good properties for parts subjected to wear. J. Trantin, Jun.,[1] has already reported on the history of the development of the manganese-steels.

The technical application of this kind of steel is limited to a material with a purely austenitic structure in which the precipitated carbide has been brought into solution by suitable heat-treatment. The austenitic state, characterized by the Gosen line in the iron/carbon diagram is stable in unalloyed and low-alloy steels at temperatures above 721 deg. C. There are, however, certain elements (manganese, nickel, cobalt) extending the α-field the addition of which keeps the austenitic structure stable at room temperature—a condition promoted by drastic quenching from a high temperature (over 950 deg. C.). The A_4 transformation point in the Fe/Mn diagram (Fig. 1) is raised with increasing manganese content, whilst the A_3 point is lowered.[2] Fig. 2 shows a section of the Fe/Mn/C system at 13 per cent. Mn. Manganese, which also lowers the A_1 point in the ternary system thus making more difficult the diffusion necessary for the austenite-pearlite transformation, reduces the velocity of the transformation to pearlite and thus aids the suppression of the pearlite stage on increasing the cooling rate. The transformation velocity of manganese-steel at room temperature is so low that no austenite decomposition occurs over a very long period, *i.e.*, the steel at room temperature is in the austenite stability range, that is to say, above the temperature of transformation to martensite. Martensite will only begin to form on cooling in liquid air or on prolonged heating in the range of higher transformation velocity of austenite (400 to 600 deg. C.). Carbide precipitation occurs on cooling manganese-steel mainly at the grain boundaries or, after cold work, at the slip planes, *i.e.*, at positions of high energy. The extreme toughness and the striking increase in hardness with deformation (surface hardness increase from about 200 to about 550 Brinell) makes manganese-steel very suitable for purposes where high resistance to both impact and wear are required. The composition of industrial Fe-Mn-C alloys is kept within the following limits: C, 1 to 1.4 per cent; Mn, 10 to 14 per cent.; Si, 0.3 to 1 per cent.; S, <0.05 per cent.; P, <0.1 per cent.

According to B. Egeberg,[3] manganese-steel can be melted in any furnace. In many cases it is produced in a converter from a cupola-melted pig-iron low in phosphorus and sulphur. For this process, the ferro-manganese is melted in the crucible which is often used for making small quantities of manganese-steel; in this case, the crucibles are heavily attacked. The basic electric furnace has also proved advantageous. Good deoxidation and degassing with small manganese loss are achieved under a lime-rich slag; very good temperature control is obtained, and, of special importance, old manganese-steel scrap can be melted down without much loss of manganese. With reducing atmospheres (in basic electric furnaces) the manganese additions can be made in the furnace; with oxidizing atmospheres (in Bessemer converters and open-hearth furnaces) the manganese losses rise. The ferro-manganese is therefore previously melted in a suitable furnace (*e.g.*, a tar-oil-fired reverberatory furnace) and added in the liquid state to the main melt in the ladle. The properties of cast manganese-steel produced by the separate melting of steel and ferro-manganese are superior to those of steel to which manganese-steel scrap has been added in one furnace. Because of its higher carbon-content and coarser structure, the latter steel has lower physical properties and medium resistance to wear.[4]

General Properties

The high deformation and work-hardening capacity of the austenitic steels is due to the high co-ordination number of the cubic-face-centred austenite. The hardness of manganese-steel in the unworked state is comparatively low (175 to 230 Brinell). The rapidity with which the material hardens with any kind of cold work is very great

*The Authors were attached to Aachen Technical High School but Professor Piwowarsky died before publication. Acknowledgment is made to British Steel Castings Research Association for supplying the translation.

Cast Manganese Steel

indeed and gives the steel the property of resisting heavy wear combined with high pressure or impact (not so resistant to sliding wear when no cold-hardening occurs). Contrary to chilled castings, which are very hard but not sufficiently tough, manganese-steel has high hardness and equally high toughness at the same time. The amount of material lost during wear is less. On this depends the application of this steel for railway and tram-line crossings and switches, dredger teeth and bucket walls, ball mills, crusher jaws, etc.

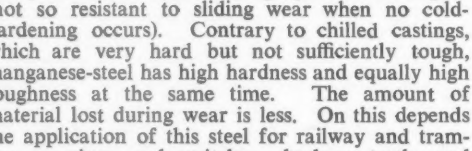


FIG. 1.—*Equilibrium diagram of the iron/manganese system.*

A disadvantage of manganese-steel is that its initial elastic limit is only 18 to 19 tons per sq. in., so that permanent deformation begins under moderate loads. The elastic limit can be raised by additions of chromium, molybdenum, or tungsten. It is exceedingly difficult to machine manganese-steel, and the only economic method of shaping it, is by grinding (or planing with Wimet). It has a low

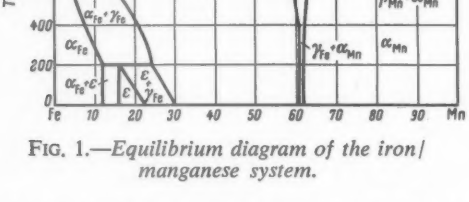


FIG. 2.—*Section of the iron/manganese/carbon system at* 13 *per cent. Mn.*

electrical-conductivity, low thermal-conductivity and is about 30 times as resistant as copper to the flow of electricity. Owing to its good weldability, it is used for building up wear-resisting surfaces by gas and electric welding; care is nevertheless necessary, as, if the beads are too thick and the heat is removed slowly, brittle carbides are likely to precipitate which interrupt the austenitic structure. Subsequent heat-treatment of the whole weld is always desirable.

Effect of Individual Elements

Sulphur takes an unimportant place in this respect; the low contents usually present can be ignored, as it occurs as manganese sulphide and passes readily into the slag. Chromium, besides increasing the strength and elastic limit, raises the wear-resistance and hardness in particular. The

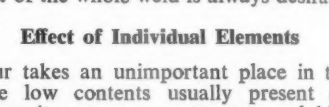

ELASTIC LIMIT, TENSILE STRENGTH IN KG/MM², ELONGATION IN PER CENT.
BRINELL HARDNESS, WORK-HARDENING CAPACITY
CARBON, PER CENT.

FIG. 3.—*Effect of the carbon content on the mechanical properties of manganese-steel, with* 13 *per cent. Mn.*

Key: F = tensile; V = work-hardening capacity; D = elongation; Str = elastic limit and H = hardness.

work-hardening property is scarcely affected and the elongation is reduced.

Additions of vanadium, chromium and molybdenum to manganese-steels improve the elastic limit; but chromium and vanadium are detrimental to the toughness; however, they raise the resistance to transformation. The sensitivity of the manganese-

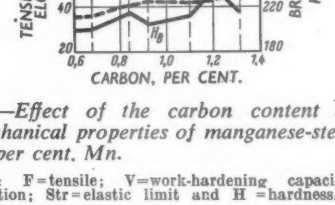

ELASTIC LIMIT, TENSILE STRENGTH IN KG/MM², ELONGATION IN PER CENT.
BRINELL HARDNESS, WORK-HARDENING CAPACITY
SILICON, PER CENT.

FIG. 4.—*Effect of silicon content on the mechanical properties of manganese-steel with* 1.1 *per cent. C and* 13 *per cent. Mn (from H. Krainer). (Key as for Fig.* 3.)

steels to superheating during heat-treatment is reduced by additions of the carbide-forming elements chromium, vanadium and molybdenum. With heavy

cross-sections, additions of more than about 0.5 per cent. molybdenum prevent carbide precipitation at the grain boundaries which is otherwise unavoidable even by quenching in water. The stability of the austenite is, however, scarcely increased at all by molybdenum.

Changes in the composition are made according to the application in view. Thus, the carbon is kept low when high toughness is required, and is increased when high wear-resistance without great pressure is demanded. The strength properties at 13 per cent. Mn in relation to the carbon content are shown in Fig. 3 due to H. Krainer.[4] Brinell hardness, elastic limit, tensile strength at fracture and work-hardening capacity all increase with increasing carbon; the highest elongation is obtained at 0.9 to 1.2 per cent. C. The wear-resistance increases in general with the carbon up to 1 per cent.; above 1 per cent. the resistance to wear depends very much on the structure (carbide precipitation). From 6 to 7 per cent. Mn upwards the brittleness of manganese-steels diminishes rapidly; elongation and strength increase up to the maximum

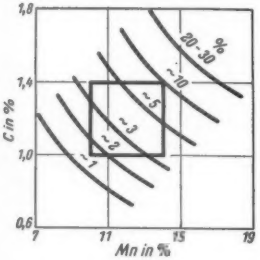


FIG. 5.—*Percentage of carbide in the as-cast austenitic structure of cast manganese - steel (from E. Maurer).*

content of 12 to 14 per cent. Mn.

The hardness is governed by the Mn:C ratio which is between 10:1 and 12:1, and the manganese content is, as a rule not less than 11 per cent. If the Mn:C ratio exceeds 10, the deformability declines (with Mn:C = 10.4 the steel can be bent through 180 deg. without cracking, with a ratio of 11 through 120 deg., and with 11.4 through only 90 deg.). According to F. Wüst,[5] high manganese contents of about 20 per cent. raise the solubility limit for carbon in γ solid solution from the usual 1.7 to about 2 per cent.

Manganese-steel can have up to 0.1 per cent. P with no detrimental effects of importance. With over 0.1 per cent. in thick-walled castings, the fracture tendency increases as phosphorus remains liquid the longest and, forced towards the centre, it segregates preferably at the grain boundaries. The ferro-manganese used generally contains 0.06 to 0.09 per cent. P. Piwowarsky[6] observed, with high phosphorus in the austenitic structure, cavities at places where, in the as-cast structure (*i.e.*, before heat-treatment) a precipitated phosphide-eutectic has been observed. More information on the effect of higher phosphorus contents will be reported in the section on the Authors' own tests.

Silicon contents between 0.3 and 1 per cent. have no important effects on the physical properties. In small amounts of about 0.55 per cent. it has a favourable effect on the density of the structure. The elastic limit rises by about 0.32 tons per sq. in. with each 0.1 per cent. Si. Over about 0.6 per cent. Si promotes carbide precipitation. Fig. 4, due to H. Krainer,[7] shows the effect of silicon on the different mechanical properties of manganese-steel with 1.1 per cent. C and 13 per cent. Mn.

Nickel up to 4 per cent. appears to lower slightly the hardness, elastic limit and tensile strength. According to H. Krainer,[7] nitrogen raises the elastic limit and deformation capacity.

Wall Thickness and Casting Temperature

In the production of manganese-steel, it is found that the steel is very fluid when pouring (the melting point is between 1,270 and 1,350 deg. C.) but it solidifies quickly and shrinks considerably. Manganese-steel castings with the as-cast coarse " stalk-like " trans-crystalline structure characteristic of too-hot pouring has a considerably reduced wear-resistance. Since, according to previous experience, heat-treatment improves this structure only slightly (see Authors' tests reported later), the casting, out-

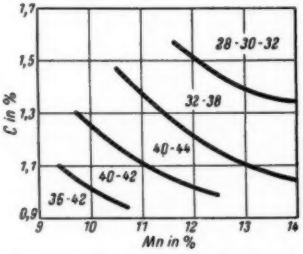


FIG. 6.—*Composition ranges, with the same strength as as-cast in relation to the manganese and carbon contents.*

wardly perfect and with normal Brinell hardness, good chemical composition and cold-bending capacity (see H. Kreutz von Scheele[8]), is nevertheless of little value. Apart from this, if the steel is poured

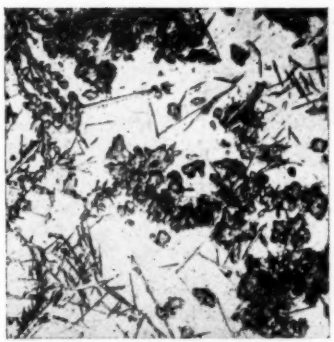


FIG. 7.—*Austenitic manganese-steel with martensite and troostite inclusions* (× 50).

too hot it tends to slag the moulding material, and for this reason alone the pouring temperature should be kept as low as possible. It must, of course, be adjusted to suit the wall thickness and it varies with

Cast Manganese Steel

this between 1,450 and 1,700 deg. C. According to F. Brunn,[9] when the temperature is correctly selected there will remain a 30 to 40 mm. (1¼ to 1¾ in.) thick deposit or "bear" in a 6-ton ladle, which breaks away on tipping it over. On the other hand, manganese-steel must be melted at a temperature sufficiently high for it to be well deoxidized. Then too, it must be hot enough for slag and inclusions, and any sand washed from the mould, to be able to rise to the surface. Sluggish steel will therefore have inclusions which will impair the physical properties (Table 1).

Special attention must be given to the shrinkage of about 2.6 to 2.7 per cent. characteristic of manganese-steel when designing castings, by avoiding sharp corners and trying to keep uniform sec-

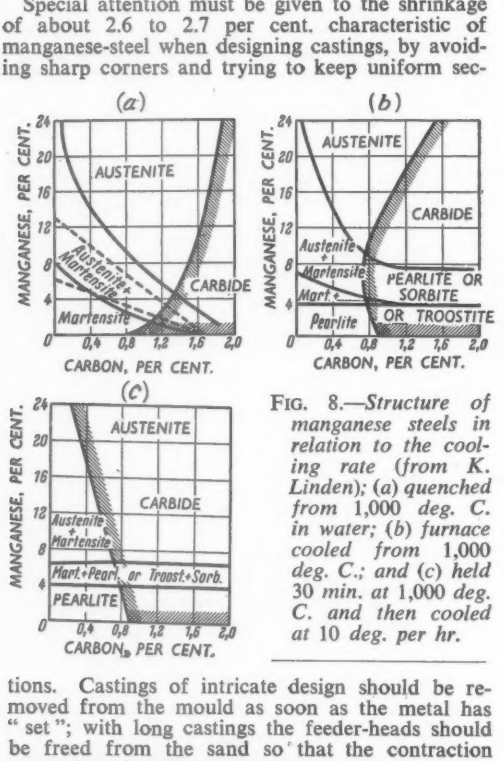


FIG. 8.—*Structure of manganese steels in relation to the cooling rate (from K. Linden); (a) quenched from 1,000 deg. C. in water; (b) furnace cooled from 1,000 deg. C.; and (c) held 30 min. at 1,000 deg. C. and then cooled at 10 deg. per hr.*

tions. Castings of intricate design should be removed from the mould as soon as the metal has "set"; with long castings the feeder-heads should be freed from the sand so that the contraction proceeds unimpeded and without crack formation. These stresses, which are particularly liable to arise after heat-treatment, are due to the low thermal-conductivity of manganese-steel (only one-sixth that of iron), and are further increased by the high coefficient of expansion; all the same, castings should not be removed too quickly from the mould

TABLE I.—*Relationship between Mechanical Properties and Pouring Temperature.*

Sample.	Pouring temperature, deg. C.	Tensile strength, tons per sq. in.	Elongation, per cent.	Reduction in area, per cent.
1	1,570	51.3	42.7	37.5
2	1,460	37.1	34.7	37

as the cold air may easily cause them to crack. It is advisable to take heavy castings out of the mould soon after solidification, clean them after knocking off the feeder-heads, and then put them in a furnace having the same temperature. Although the tendency to-day is to increase the upper limit of wall-thickness, it must nevertheless be borne in mind that complicated castings often cannot be heat-treated right through, for a steam blanket

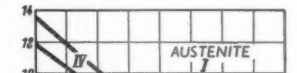


FIG. 9.—*Development of structure of manganese-steels on cooling in air (from L. Guillet).*

easily forms which prevents rapid cooling. Manganese-steel, being a poor conductor of heat, will only harden to a limited depth so that thick-walled castings must be quenched from a high temperature.

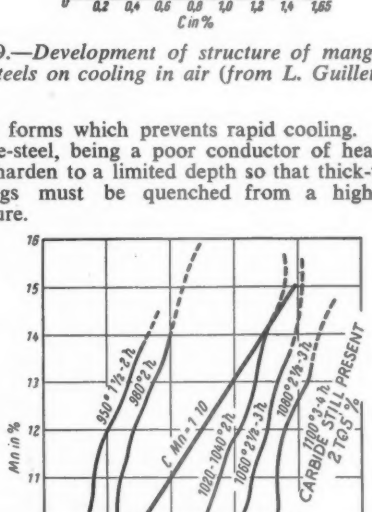


FIG. 10.—*Curves of equal heat-treatment for manganese-steels (from F. Roll).*

As-cast Structure

The as-cast structure of cast manganese-steel generally consists of austenite crystals with a fair amount of grain-boundary carbides, which when strongly developed—due to high pouring temperatures—so crystallize that they lie within the grains.

Sometimes the carbides are arranged in lines and after macro-etching may have a dendritic appearance.

The melting procedure also has its effect. Remelted charges with high manganese-steel scrap have a higher proportion of undissolved carbides because of the reversion of the high carbon-content. If there is more than the 1:10 ratio of carbon present in the casting, then, according to E. Maurer's diagram, greater precipitation of manganese-rich cementite or ledeburite (Fig. 5) is to be expected. A proportion of 10 per cent. carbide, as-cast, is permissible. The ranges for equal strength as-cast, which are similar to the ranges for equal carbide-precipitation, are shown in Fig. 6. The Brinell hardness as-cast is from 175 to 146 tons per sq. in. and this increases if other cooling conditions cause troostite-pearlite precipitation. Fig. 7 shows a structure of this kind in which martensite as well as troostite are present.

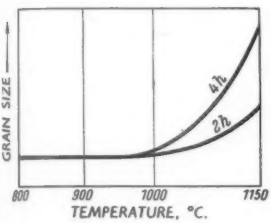


FIG. 11.—*Increase in grain size in relation to annealing temperature (from F. Roll).*

The fracture as-cast is from dull grey to bright, and dull grey means a brittle structure with a "stalk-like" to irregular globular grain. Owing to its very detrimental effect on the steel, the "stalk-like" grain is to be avoided, especially as a complete conversion of the structure is not obtained by water-quenching. The tendency to dendritic structure decreases with increasing carbon-content, but is stronger the more the melt is superheated and the casting temperature is raised. The development of a completely austenitic structure on fairly-rapid cooling is only possible, according to G. Guzzoni,[10] because of the large hysteresis loop between Ac_1 and Ar_1, although the austenite at 12 to 14 per cent. Mn is still stable at ordinary temperatures.[11]

How greatly the structure of manganese-rich steels is dependent on the cooling rate is shown in Fig. 8 from a paper by K. Linden.[12] Its components, derived from cooling in air, have been shown by L. Guillet (see Fig. 9).

Attempts to obtain a purely austenitic structure without the usual heat-treatment (quenching in water from 1,050 deg. C.) are fraught with difficulty. That it is possible to get an austenitic structure without heat-treatment in castings with wall-thickness less than 20-mm. ($\frac{3}{4}$-in.) thick if they are quenched in water from red heat has been shown, and investigated; so too for 10-mm. ($\frac{3}{8}$-in.) thick and cooling in air, but in this case there is great risk of cracks.

With unheat-treated test-pieces, the carbon content diminishes from surface to core. With heat-treated test-bars the surface layer is often severely decarburized which reduces the wear-resistance.

Determining Castability

Up to the present, various kinds of spiral mould have been used to determine castability, among these, A. Courty's test[13] is a well-known one, but the length of spiral, which is cast in green sand, depends, other things being equal, on the moisture in the sand, the degree of ramming, and the sand grain-size. Again, if there is a certain amount of turbulence in the runner, this is detrimental to the

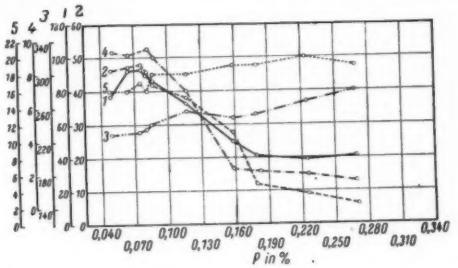


FIG. 12.—*Effect of phosphorus on the deflection and transverse strength (initial melt).*

Key: (1) transverse strength (kg. per sq. mm), (2) deflection in mm, (3) Brinell hardness, (4) impact strength (m.kg per sq. cm), (5) magnetic susceptibility (distance from magnetic pendulum in mm).

results. In the present investigations, the test spiral consisted of an assembly of moulds made by the shell-moulding process which were described in detail by Ph. Schneider.[14] The non-turbulent runner is set up on top of the assembled shell-moulds and supported in 30-cm. (12-in.) layer of sand. To measure the spiral length, it was placed on top of a template graduated in centimetres. The results are reported in the section on "Effect of Pouring Temperature."

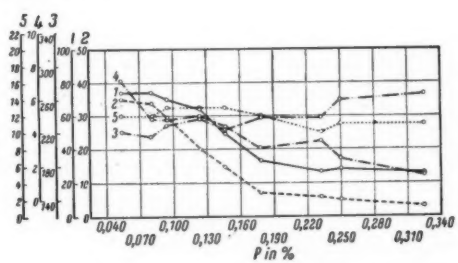


FIG. 13.—*Effect of phosphorus (remelted charge).*

Key: (1) transverse strength (kg. per sq. mm), (2) deflection in mm, (3) Brinell hardness, (4) impact strength (m.kg per sq. cm), (5) magnetic susceptibility (distance from magnetic pendulum in mm).

Heat-treatment

The object of the heat-treatment is to impart high toughness and wear-resistance to the comparatively

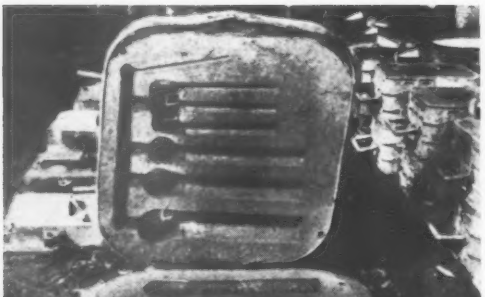


FIG. 14.—*Arrangement of test-bars in the moulding box.*

brittle casting by dissolving the carbides and producing a purely-austenitic polyhedral structure. Regarding this, F. Roll[15] emphasizes that the treatment must conform to a definite schedule for each narrow analysis range. Investigations of the effect of annealing time and temperature on the physical properties showed (Fig. 10) that there were certain ranges of Mn + C contents requiring the same holding time and temperature. From this it is seen that with high C : Mn ratios it is hard to get the carbides in solution.

For any quench effect determined by the annealing and bath temperatures, the depth of hardness is

FIG. 15.—*Set of test-bars as-cast.*

dependent on the quenching medium and the agitation. The austenite transformation in any part quenched at below the critical cooling rate in a bath at room temperature can be expected to give a mixed structure. In general, castings are heated in an atmosphere as near neutral as possible to a temperature of 1,000 to 1,050 deg. C. and quenched in water at 20 deg. C. At 1,050 deg. C. the holding time is 1 hr. for each 25-mm. (1-in.) of thickness. Prolonging the annealing time leads to grain growth (Fig. 11). Unfortunately almost every manganese-steel casting has a decarburized surface-layer.

AUTHORS' TESTS

Effect of Phosphorus

The tests to determine the effect of casting temperature and wall-thickness preceded those relating to the influence of high phosphorus-contents. Successive additions of phosphorus above the normal content of 0.04 per cent., after a short initial increase in the deflection and bend strength, led to a

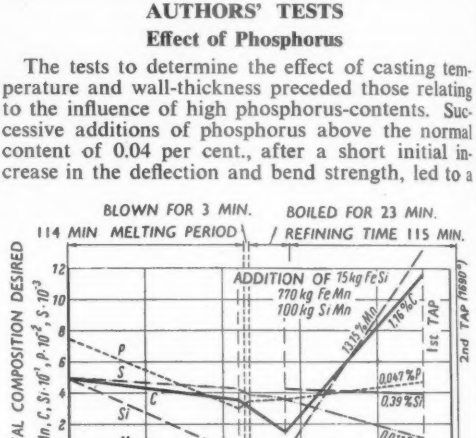


FIG. 16.—*Record of test-melt S.*

marked fall in these property values. In these tests, the curves for the initial charges* lay above those for remelted charges (Figs. 12 and 13).

The increasing phosphorus-content caused more and more randomly distributed, greyish white, iron-manganese-phosphides to appear in the microstructure within and at the boundaries of the grains.

Producing the Steel

The manganese-steel for carrying out the tests was produced in a 3-ton electric arc furnace. The lining consisted previously of one layer each of fireclay and magnesite bricks which were protected by a 30-cm. (12-in.) layer of rammed tar-dolomite mix. The outside of the wall was insulated by fireclay bricks and the inside was rammed with tar-dolomite. The cover was provided with cooling rings of silica bricks. After the rebuilding, the bottom consisted of pure dolomite with a flat layer of magnesite bricks and the walls of dolomite bricks. The round brickwork-cover consisted of a ring of supporting dolomite bricks, two dolomite rings, and at the centre, silica bricks encased with

* The charges in which the manganese content is built up are called in this translation the "initial charges" to distinguish them from the remelted charges.

tar-impregnated cardboard and sheetmetal. All the ladles were lined with dolomite bricks.

The following types of steel were investigated:—

(*a*) *Initial charges.*—Ordinary steel scrap and steel feeder-heads were melted down in the basic furnace at about 1,400 deg. C. Oxygen was injected for 3 min. at 10 atm. This raised the bath temperature to 1,500 to 1,600 deg. C., at which it boiled, and the carbon was oxidized away leaving 0.10 per cent. A lime addition raised the basicity of the slag. During the boil, the slag reduced the phosphorus in the bath (0.08 per cent.) to a residual 0.02 per cent. The high-phosphorus slag was tapped off, manganese was added by degrees as ferro-manganese or ferro-silicon and melted under a thin layer of basic slag. This ferro-manganese addition raised the phosphorus again to about 0.05 per cent. The silicon addition, which was the first to burn away during the boil, amounted to 0.5 per cent. in order to give the steel greater density by deoxidation. Having added all the alloys, the slag was prepared by additions of lime, fluorspar, and coke breeze, so that there was a white slag by the time the refining period began. When high temperatures were reached, the sulphur passed into the slag as manganese sulphide, 0.01 to 0.02 per cent. remaining in the bath. The heat time was 3.5 to 4 hr.

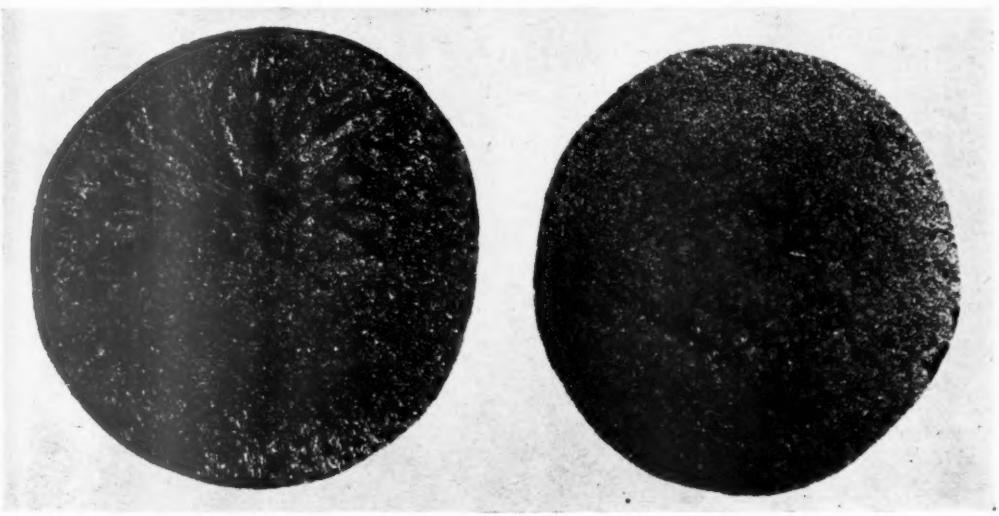
(*b*) *Initial duplex charges.*—The liquid charge consisted of steel scrap and hematite which, on melting in the cupola, had 2.8 to 3 per cent. carbon and 1 to 1.2 per cent. silicon; it was then blown in a Bessemer converter. (Silicon, manganese and carbon burned away leaving about 0.05 per cent. carbon.) This charge was then carburized to about 0.30 per cent. carbon in the electric furnace and refined with ore, during the boil the carbon fell again to 0.10 per cent. The steel was clean after slagging off, and it was then treated in the same way as the other initial charge (*a*) after the first slag. The total heat in this case took only about 2½ hr.

(*c*) *Remelted charges.*—The charge consisted mainly of manganese-steel scrap. After melting down, oxygen was blown through and the charge deoxidized up to formation of a white oxide-free slag. As the bath does not boil owing to the high manganese-content, impurities are likely to remain in it. Remelted charges are generally somewhat higher in carbon than initial charges and the steel is not of such a high quality; the structure is usually coarser and it contains more grain-boundary carbide. The melting period is short (2½ to 3 hr.) as the high carbon and manganese-contents lower the melting point. Attempts, using oxygen to burn out the carbon preferentially, were unsuccessful, as it is only at high temperatures (1,850 deg. C.) that the carbon burns before the manganese. Owing to the chromium content of the remelted charges no tests were made with them.

Preparation of Test-bars

To determine the effect of casting temperature and wall-thickness on the primary structure, test-bars 10, 20, 30, 40, 60, 80, 100-mm. in dia. (⅜ to 4 in.) were constantly cast at all temperatures used in foundry practice. The large number of bars made it possible to eliminate fluctuations and in particular to detect errors in the melting procedure. Table II gives a list of selected initial ordinary, and initial duplex, charges covering the temperature range 1,460 to 1,700 deg. C. In order to maintain equal

FIG. 17.—(*left*) *Coarse structure with marked grain-coarsening in upper half of the bar;* (*right*) *fine grain-structure* (*actual size*).



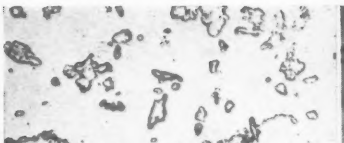


FIG. 18.—(*left*) *Microstructure of feeder-head, 40-mm. thick* (× 50).

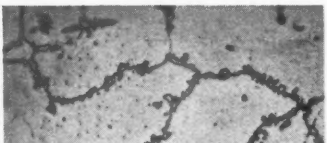


FIG. 19.—*Microstructure of feeder-head, 100-mm. thick, sample from same melt as in Fig.* 18 (× 50).

conditions as far as possible (same moulding material, same composition and temperature) for each series, the bars were moulded in one box and cast horizontally (Fig. 14). To obtain a dense structure a feeder-head was provided at the front end of each bar, as shown in Fig. 15. The moulding material consisted of one part green Rosenthal sand, two parts used sand, and 3 per cent. sulphite lye, plus a dry sulphite-base binder. There was 1.7 per cent. moisture, the gas permeability was 200, and the green strength 9.94 to 11.3 lb. per sq. in. A Bioptix pyrometer by Hase-Naeser was used for temperature determinations. This colour pyrometer measures the black-body radiation and the colour temperature (true temperature). Checks showed the determinations to be very accurate.

In making the manganese-steel, the procedure for heat No. 7861 was recorded (see Table II), and the log is given as an example in Fig. 16. The charge consisted of 3 tons 16 cwt. steel scrap and 1 ton of steel risers with a mean composition of 0.5 per cent. C, 0.35 per cent. Mn, 0.5 per cent. Si, 0.075 per cent. P, and 0.05 per cent. S. The charge was melted down in 1½ hr. (about 1,400 deg. C.) (see Fig. 16, sample I). To raise the temperature more quickly, oxygen was blown in at 6 atm. for 3 min., thus initiating the boil (Fig. 16, sample II), which lasted 22 min. (Fig. 6, sample III). The initial basic-slag was removed and then the ferro-silicon and ferro-manganese added in stages (15 cwt. of 82 per cent. FeMn, 220 lb. 66 per cent. SiMn, 33 lb. 45 per cent. FeSi). By so doing, the ferro-silicon completely took up all remaining oxides before the ferro-manganese addition. The refining lasted 1½ hr. (Fig. 16, sample IV). Thus, the time to the first tap was 4¼ hr. with a current consumption of 2,800 kwh., or 493 kwh./ton. In this period the silicon was completely burnt away (no boiling before this!), and the manganese and carbon mainly during the boil. Preferably at not too high a temperature, the phosphorus passes into the slag (hence not so much during the blowing period in which some phosphorus reverts to the bath, but it is then removed with the first slag). The ferro-manganese addition is accompanied by an increase in the phosphorus during the refining period. The sulphur content now falls gradually, more rapidly as the refining proceeds, as it is only at higher temperatures that the sulphur combines to form calcium sulphide in the slag.

TABLE II.—*Melting Time, Melting and Casting Temperatures, Current Consumption and Composition of Some of the Initial and Duplex-melted Manganese-steels Investigated.*

Melt No.	Charge No.	Type of melt.	Melting time.	Melting temp.	Casting temp.	kwh per ton.
			hr. min.	deg. C.	deg. C.	
1	7,809	Duplex	2 5	1,525	1,490	441
2	7,839	Duplex	2 45	1,605	1,520	471
3	7,846	Duplex	3 —	1,616	1,570	478
3A	7,897	Duplex	3 —	1,610	1,575	480
4	7,852	Duplex	3 20	1,660	1,630	484
5	7,821	Duplex	4 —	1,700	1,685	493
6	7,848	Initial	4 10	1,580	1,460	480
7	7,848	Initial	4 10	1,580	1,510	480
8	7,841	Initial	4 20	1,620	1,570	473
9	7,841	Initial	4 20	1,620	1,605	473
10	7,923	Initial	4 30	1,725	1,695	480
S	7,861	Initial	4 15	1,690	1,450 to 1,657	493

The compositions of these melts were:

Melt No.	C, per cent.	Si, per cent.	Mn, per cent.	P, per cent.	S, per cent.	C : Mn ratio.
1	1.26	0.51	13.37	0.038	0 009	1:10.6
2	1.19	0 35	13.09	0.045	0 011	1:11.6
3	1.22	0.42	12.60	0.072	0 012	1:10.3
3A	1.16	0.49	11.57	0.036	0 008	1:10.0
4	1.16	0.47	13.41	0.047	0 030	1:11.5
5	1.22	0.51	13.37	0.038	0.012	1:10.5
6	1.18	0.77	13.20	0.043	0 011	1:11.1
7	1.18	0.77	13.20	0.043	0.011	1:11.1
8	1.19	0 39	13.39	0.034	0 012	1:11.2
9	1.19	0.39	13.39	0.034	0 012	1:11.2
10	1.10	0.59	13.41	0.045	0 012	1:12.2
S	1.24	0.47	13.41	0.063	0.010	1:10.8

The bath and slag analyses are given in Fig. 16 and Table III. The desired analysis was 1.1 to 1.2 per cent. C, 12.5 to 13.5 per cent. Mn, 0.50 per cent. Si, 0.050 per cent. P, and 0.020 per cent. S.

TABLE III.—*Slag Analyses from Melt "S" in Table II (per cent.).*

Sample No.*	SiO_2	Total Fe	Mn	Al_2O_3	CaO	MgO	Colour.
I	28.8	19	8.6	2.4	20	7.14	Greyish black
II	24.3	19	7.2	1.1	32.7	8.6	
III	21.7	20.5	6.9	1.8	32.1	6 65	
IV	28.1	4	—	2.1	50.05	9.6	White

* The slag samples were taken at the same time as the metal samples, which are given in Fig. 16.

In the evaluation, examination of the fractures of the bars enabled the first conclusions to be drawn.

In all the series, it was observed that a marked change in the grain occurred with bath temperatures of about 1,530 to 1,550 deg. C. The fine-grained dull fracture changed into a brilliant silvery-grey coarse grain. This difference can be recognized by the marked grain-growth around 1,530 deg. C. visible in the micrographs from the series, and especially by the change in grain type. Independent of this, all the thicker bars, frequently from 60-mm. ($2\frac{3}{8}$-in.) in dia. upwards, were coarser in the upper half of the bar than in the lower. This phenomenon, which is shown in Fig. 17, and which occurred in both fine and coarse-grained structures, was put down to lack of ferrostatic pressure which was less apparent in the thinner bars, but must nevertheless be borne in mind.

The micrograph confirmed this phenomenon in the small bars, as in these too, some larger grains were present above the centreline. This lack of pressure led to minute shrinkage-cavities associated with a coarse dendritic-structure. The belief that crystals formed from " abnormal " nuclei has moved down by gravity thus making possible a dendritic zone in the upper portion, does not seem a likely explanation. This phenomenon did not occur with vertically-cast bars the structure of which was uniform over the whole length. To obtain a valid comparison, sections were always prepared from the same position namely, just below the centreline. It was not possible to prevent a slight deformation, visible in the graphs at the slip planes, when fracturing the bars, owing to the great toughness as-cast.

On the other hand, there was no explanation for the phenomenon that all bars for heat No. 3 were grained absolutely radially, a fact which was confirmed on castings with wall thicknesses up to 40 to 60 mm. ($1\frac{5}{8}$ to $2\frac{3}{8}$ in.). It was at first presumed to be an effect of high moisture in the sand, but this was not confirmed by " blind-class " test-bars. As there was no difference in the melting procedure, only the casting temperature could be responsible for this. The phenomenon did, in fact, occur with all heats of the same temperature of about 1,570 deg. C.

Surprisingly enough, with many heats (and very obviously with heats 1, 3, 6, 7, 8 and 10) the 20-mm. ($\frac{3}{4}$-in.) bar did not conform to pattern, as, when compared numerically with other bars, including those of smaller diameter, they had less grain-boundary carbides. An explanation is to be sought in the arrangement of the bars in the mould, since, as is seen in Fig. 14, the 20-mm. ($\frac{3}{4}$-in.) bar is on the outside it is not so subject to the heat from other bars. That this did not occur with the 100-mm. (4-in.) bars is no doubt due to the mass of metal and this applies equally to the 10-mm. ($\frac{3}{8}$-in.) bar lying quite by itself. With this one, the very rapid chilling (only seldom was the whole bar cast) did not permit any secondary effects. The 10-mm. bar, as the last one, was filled with a steel which passed through a highly-heated runner and gate and it therefore fulfilled the requirements for greater precipitation of carbide. This theory was also confirmed by comparing the casting with the runner. Fig. 18 shows a micrograph from the runner only 40-mm. ($1\frac{1}{2}$-in.) thick, and Fig. 19 the structure of the 100-mm. (4-in.) bar from the same heat. The runner, through which the steel had been poured, thus heating up the sand very much, has larger grains and more carbide precipitation than the 100-mm. (4-in.) bar. In a special test on this question, an additional 20-mm. ($\frac{3}{4}$-in.) bar was moulded in the centre of the box between the 40- and 60-mm. ($1\frac{1}{2}$- and $2\frac{3}{8}$-in.) bars; this appeared to confirm this explanation, in that this additional bar did, in fact, have coarser carbide-precipitation, and it thus came within the picture of the presumed relationship.

Metallographic Specimen

The production of the metallographic specimen was fraught with great difficulty owing to the peculiarity of cast manganese-steel. Discs had to be cut from the fractured bars for further preparation—a task which could not be done mechanically. Discs were therefore burnt off—great care being taken in order to prevent the heat affecting the fracture (burning with water-cooling, or submerged burning were applied). From the discs from the larger bars 60 to 100 mm. ($2\frac{3}{8}$ to 4 in.) dia. smaller specimens again had to be burned in order to get pieces which the grinding machine could take. The grinding and lapping required a long time for the removal of the outer heat-affected zones, especially as heating had to be prevented. The specimens were etched with 1 to 3 per cent. nitric acid, upon which the crystals with the more extensive carbide-precipitation and slip lines were not so heavily attacked and therefore appeared darker. For the micrographs 50 magnifications was selected so that a grain count could be made from at least some of the melts, as well as to make reliable comparisons possible.

(To be continued)

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Data Sheet

ALAR, Limited, 3, Albemarle Street, London, W.1, have just issued a data sheet covering five alloys, but these account for over 80 per cent. of the aluminium castings made in this country. Such an abbreviated list will find much use in foundries. It is available to readers on writing to ALAR.

To correspond with the mounted Data Sheet issued in January this year (to comply with revised standard BS 1490), ALAR, Limited, have now published a new set of sheets to fit the folder of ALAR technical data (originally published in 1949). Copies are available from the company at 3, Albemarle Street, London, W.1.

Back-log

When considering what to publish in this issue, after a break since February 16, it was first thought "stale news was no news" and attempts to catch up on the back-log of information, reporting what has happened since that date, would not be appreciated by readers. However, attendance of the writer at last month's London conference on the CO_2 Process (organized by the British Cast Iron Research Association) served to show the mistakeness of the impression that the industry is not interested in recent history. At this conference, spare-time gossip on every hand was: "Did you know that Mr. X had joined Y & Company, Limited . . . ?" "Have you heard that such and such a firm has changed hands?" "Is there any truth in the rumour . . . ?" "Mr. A. Prentice has gained the . . . award," and so on. Everywhere there was a thirst for knowledge to fill the few weeks gap in the diary of day-to-day affairs which could be taken both as a compliment to the JOURNAL in its rôle as the newspaper of the industry and a measure of the void caused by its temporary suspension, however unavoidable that may have been. It has been resolved, therefore, in this "back-log" to try and fill in the void, as briefly as possible, with some of the news of awards, personnel changes, promotions, etc., in the foundry and kindred industries in the intervening period:—

Recent appointments, nominations or elections to office include the following: Mr. D. K. COUTTS, M.SC., A.R.I.C., becomes manager for the Mond Nickel Company's technical office in Bombay (succeeding Mr. H. MCNEIL, who died recently). Councillor H. P. TAYLOR, manager of the Lichfield works of Chamberlin & Hill, Limited, grey-iron founders, has been unanimously nominated as Sheriff of the city for the coming year. Mr. H. HEATH has been appointed to the board of Associated Engineering Holdings, Limited, on the resignation of Mr. F. P. L. JACKSON. Traversing the country for news, Mr. JAMES NEIL DEAS has been elected chairman and managing director of Federated Foundries, Limited, Glasgow, in succession to the late Mr. WILLIAM RENNIE, and Colonel WALTER MACFARLANE becomes deputy chairman (both are founder directors); Dr. A. H. SULLY, in Sheffield, has succeeded Prof. R. J. SARJANT as director of research at the British Steel Castings Research Association, but Prof. Sarjant will continue to act in an advisory capacity to the Association; Mr. C. W. HOTCHEN has been made works manager (production) at the factory of Smiths Aircraft Instruments, Limited, Cheltenham. Short Brothers & Harland, Limited, have appointed Mr. J. DENT assistant chief engineer, guided weapons. Mr. WILLIS BUTTERS, managing director of Butters Bros., Limited, Glasgow, has been elected vice-chairman of the St. Andrew's Ambulance Association in succession to Mr. T. C. YOUNG. The new inspector of factories for the Sheffield North District is Mr. J. L. HOBSON. The Minister of Labour and National Service has appointed Mr. J. L. EDWARDS to be his principal private secretary in succession to Mr. C. F. HERON. Mr. STANLEY BROOKS PERRY has been appointed to the board of the National Steel Foundry (1914), Limited. At the Birmingham University, Dr. E. C. ROLLASON has been appointed to the Chair of Metallurgy in succession to Professor A. J. MURPHY, who resigned some time ago to take up the post of principal of the College of Aeronautics, Cranfield. In order to devote his whole time as chairman of the Weir Group of companies, Mr. J. K. WEIR has resigned as joint managing director of G. and J. Weir, Limited, and Mr. J. RUSSELL LANG has been appointed sole managing director of the company; Sir CHARLES CONNELL has been made an additional director. Mr. R. D. BURN, technical consultant to the British Metal Corporation, has accepted an invitation to become a member of the technical committee of the International Tin Research Council.

First-prize winner in the recent John Surtees junior competition (sponsored by the Scottish branch of the Institute of British Foundrymen) was JAMES MCNAB, and the third (equal) prize winner JAMES A. WATSON; both are students at the School of Engineering, Burnbank. Other Scottish names in the news include a Lossiemouth man, Dr. A. M. SMITH, who has been appointed senior physicist in the nuclear group of Rolls-Royce, Limited. Mr. STANLEY F. STEWARD, C.B.E., has been elected a director of Lancashire Dynamo Holdings, Limited, and succeeds Mr. H. W. BOSWORTH as chairman of the board of Lancashire Dynamo & Crypto, Limited.

Resignations and retirements include the following: The retirement last month of Mr. W. W. WATT, director of the British Oxygen Company, Limited, and Mr. S. A. BRAZIER, technical manager of Dunlop's general rubber-goods division (the latter after 37 years in the industry). Mr. D. G. FLETCHER, who was in charge of the order department of the Turner Tanning Machinery Company, Limited, Bramley, Leeds, was presented with a gold wristlet-watch on retirement after 50 years' service. Sir JOHN BOYD has retired from the vice-presidency of the Shipbuilding Employers' Federation. English Steel Corporation announce the retirement of Mr. J. S. VARLEY, of the overseas sales department, and Mr. ERNEST GILL, manager of the open-hearth melting shops at the Grimesthorpe Works. Mr. G. G. IBBOTSON, a local director of Newton Chambers & Company, Limited, Thorncliffe, and the secretary of the Scottish Scrap Iron, Steel & Metals Association, Mr. JAMES ALEXANDER, have also retired. Resignations have been received from Mr. T. A. IRVINE, a director of the Fullwood Foundry Company, Limited, Lanarkshire; Mr. J. S. HUTCHISON, a director of Metal Industries, Limited, Glasgow; Dr. T. B. CROW has resigned from Foundry Services, Limited, to take up an appointment with E. A. Lewis & Company, Limited, of Birmingham.

Other events in which personalities or organizations in the industry have figured include the visit of the Minister of Education, Sir DAVID ECCLES, to the National Foundry College, Wolverhampton; the installation of Mr. ALICK S. DICK, managing director of the Standard Motor Company, Limited, as president of the Coventry Chamber of Commerce; a presentation to Mr. CECIL E. BARWELL, chairman of the Birmingham brassfounding firm of James Barwell, Limited, on celebrating the diamond anniversary of his entering the company's service, the golden anniversary of his rise to directorship, and the silver anniversary of his appointment as chairman. A presentation has been made to Mr. A. F. HODGSON, managing director of Joseph Sankey & Sons, Limited, to mark his gaining the award of the C.B.E. Mr. W. BROWN, of the Palatine Engineering Company, Limited, has agreed to act as chairman of the Lancashire & Cheshire area of the Association of Bronze and Brass Founders for a period of at least 12 months.

A note of the nomination of Alderman ROBERT NEILL, head of the firm of Robert Neill & Company (Sheffield), Limited, electrical engineers, as the city's next Lord Mayor, has been received, and Tyseley Metal Works, Limited, have announced that Mr. W. G. F. CROSS, an employee who has served the company for many years in the Midlands, has been transferred to their London office to replace Mr. A. W. G. SMITH, who has left the concern.

Pressure-die-casting Recommendations

Abstracts from OEEC Report

The recently issued report on "Zinc and Light Metal Die-casting" (meaning pressure-die-casting), published by the European Productivity Agency of the Organization for European Economic Co-operation" begins with recommendations based on the study of American methods. From these, the following are abstracted:

Alloys

1. Die-casters should standardize as far as possible the specifications for zinc and aluminium alloys.
2. The die-caster should guide the customer in the choice of one of the standard alloys for each application.
3. The use of spectrographic analysis, which combines speed and accuracy, should be encouraged for both zinc and aluminium alloys and spectrographic standards should be made freely available.
4. An adequate standard of purity in zinc alloys should be promoted by the introduction of certification schemes like those already in existence in the United States, France, Germany and the United Kingdom.
5. Casting scrap should not be allowed to accumulate, but should be fed back to the melting pot by a conveyor or other direct means.
6. In the case of zinc alloys, when a high proportion of scrap is remelted, spectrographic analysis should be carried out, with particular attention to the magnesium content.

Design of Castings and Dies

1. The first contact with the die-caster should be made in the early stage of design of a product, and contact should be made when necessary between die-caster and customer during die-making and production.
2. There should be agreement on the degree of finish required before the die is designed.
3. Die-casters should continue to educate customers in die-casting design and should give them personal assistance until they really understand how to design castings suitable for production by this process.
4. The die-casters' representatives should be technical men who are also well informed of the characteristics and costs of parts made by other mass-production processes.
5. Die-casters and customers should agree on tolerances required. The widest permissible tolerances should be allowed. Where extra-fine tolerances are found to be essential, adjustments in price may become necessary.
6. Sharp edges and heavy masses should be avoided and wall thicknesses kept even wherever possible.
7. In co-operation with the customer, parts should be designed to keep to the minimum the use of sliding cores, inserts or other features tending to reduce the rate of production or increase the breakdown-time of a die-casting machine. When inserts are necessary, they should be adequately located in the die.
8. An adequate number of ejector pins should be provided and should in the main be located on overflow wells, gates and, where necessary, specially designed bosses. Sleeve ejectors should not be used unnecessarily for aluminium castings.
9. Overflow wells, vents and controlled flash should be provided to ensure sound castings and precise trimming.

Dies

1. Specially formulated die-steels should be used, though caution is necessary because some European steels of the same nominal composition as the American steels are not quite equivalent in properties.
2. Gates and runners as well as casting impressions should be polished and kept smooth.
3. All dies should be heat-treated if for use with aluminium alloys or for making long runs of zinc-alloy die-castings. Customers should be told that modifications after heat-treatment are expensive and sometimes impossible.
4. Nitrided steel should be used for ejector pins.

Die-casting Machines

1. To achieve the maximum production rate, the physical and mental effort required of the die-casting machine operator should be minimized, *e.g.* by the use of semi-automatic machines.
2. The position of machine controls and holding pots should be planned for ease of operation.
3. Die-casting-machine operators should wear protective goggles.

Temperature Control

1. The optimum die-temperature, metal-temperature and cycling time should be carefully established for each new die and the machine then worked with as few breaks as possible in its operation. Qualified engineers should be responsible for getting each die working properly and should remain in charge of it until the die is giving reasonable production.
2. Carefully planned water-cooling lines should be provided to improve the quality of castings and the speed of production.
3. Holding pots should have automatic temperature control and should be fed with molten metal to avoid temperature fluctuations.

Die Lubricants

1. The use of lubricants should be kept to the minimum. It is often advantageous to lubricate lightly before every shot rather than more heavily every two or three shots in the case of aluminium alloys.

Pressure-die-casting Recommendations

2. Zinc-alloy die-casting dies should only be lubricated when and where necessary.

Inspection

1. Castings should be inspected as soon as possible after production to avoid the accumulation of a large number of rejects before a fault is discovered.

2. Die-casters should use the same inspection methods and gauges, etc., as the customer.

Handling

1. Machines should be laid out to reduce the handling of castings to the minimum. Where possible, ancillary machines should be capable of re-arrangement to suit particular jobs.

2. Simple conveyor systems should be installed wherever possible, otherwise mechanical handling devices, such as fork-lift trucks, should be used to keep work moving and reduce handling costs.

3. Raw materials and goods for despatch should be " palletized " as far as possible.

Trimming

1. Mechanical, hydraulic or pneumatic power presses should be used whenever possible for trimming operations.

2. The blanking of holes in thin sections should be considered in preference to coring.

3. Compressed-air jets should be used to keep trimming tools clean.

4. Small hand-operated power tools and fixtures, backstand idler belts and barrels should be used more extensively to reduce the cost of deburring.

Machining

1. The cost of machining operations should be accurately estimated in advance. The die-caster should study the details of finishing processes very carefully to be sure of working as economically as possible in the production of a part.

2. Multi-spindle machines for drilling and tapping, etc., should be used to reduce costs.

3. Carbide-tipped drills should be used to reduce the frequency of re-grinding, and quick-spiral drills have proved advantageous.

4. Air-operated jigs should be used whenever possible.

Polishing

Wherever a first-class finish is required, the use of standard polishing mops is essential.

Cleaning

Two-phase cleaning solutions should be used instead of trichlorethylene to remove polishing residues.

General

1. The interchange of technical information in Europe through a recognized agency such as the European Pressure Die Casting Committee is recommended for the benefit of the industry as a whole.

2. All possible steps should be taken to increase the demand for die-castings, so as to enable the producers to operate with increased productivity.

3. Universities, technical colleges and schools should be encouraged to give die-casting the prominence as a production process that it deserves.

4. To approach the high American production speeds, the die-casting process should be the subject of continual study. The general knowledge gained from such a study should assist in improving production efficiency.

Forty Years Ago

In the March, 1916, issue of the FOUNDRY TRADE JOURNAL, much space was devoted to the problem as to whether cast-iron shells would not answer just as well as steel. As there was no real shortage of steel, but rather of machining facilities, the question solved itself. There was an article on the machine moulding of hand-grenades, a somewhat surprising inclusion, as in those days their production was more or less in the " secret list." By and large, the issue was not as interesting as most of that period. Amongst new companies registered was Dudley Foundry Company, Limited.

The April, 1916, issue of the JOURNAL was particularly interesting as it commented initially on the legal passing of the system of pig-iron warrants—a system which had served its purpose well when there were a very large number of small blast-furnaces. In that system, by selling to a central depot the pig-iron maker received his money; the warrant then not only became a marketable entity but a gambling unit. Wisdom was shown editorially by insisting that but little importance should be attached to the known shortage of manganese in Germany as a factor in winning the war. A paper on apprentice training by Mr. V. A. Mundella stressed the need for day-time release for boys to go to the technical schools. Probably the shortening of working hours made the need less urgent than it was under the 6 a.m. to 5 p.m. working day.

CO_2 Progress!

As an indication of continuing progress with the adoption of the CO_2 Process, Mr. A. Talbot, whose account of early experiences with the Process was published only last year,* states that his whole foundry production of dried moulds and cores is now effected by CO_2 hardening. In fact, Mr. Talbot goes so far as to indicate that the core and mould stoves of his firm (Western Foundries) are now redundant. A problem still remaining to be solved is full-scale sand-reclamation of knocked-out moulds and cores, but it is hoped that current investigations will yield satisfaction in this sphere also.

* Published in the JOURNAL, May 26, 1955.

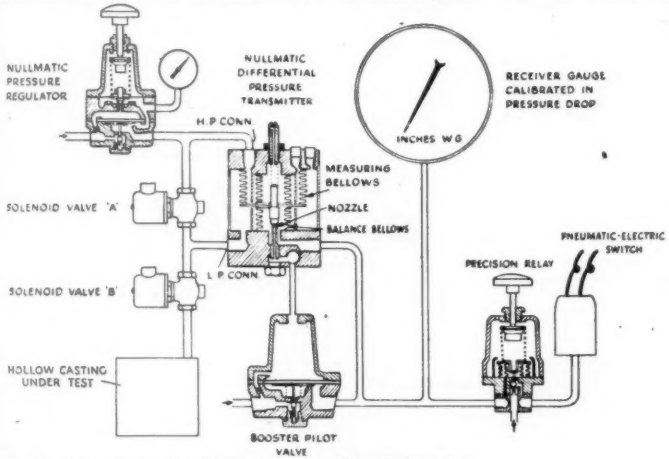
Tom Makemson Memorial Award

There is every reason to believe that the IBF Tom Makemson Memorial medal and prize will be available for award to the student showing the best result in the next examination to be held by the City and Guilds of London Institute, covering the final course for patternmakers. The award will take the form of a bronze medal and a sum of about £20, to be expended on the provision of patternmakers' tools. If the winner lives in an area served by a branch of the Institute of British Foundrymen, then the award will be presented at a suitable meeting of that body.

Equipment and Supplies

Leak-test Cabinet

Sunvic Controls, Limited, of 10, Essex Street, London, W.C.2, recently staged a demonstration of their leak-test cabinet, claiming that it offers considerable advantages over other systems in use. Their system uses a combination of three process-control instruments to determine the acceptability of hollow castings in regard to pressure-tightness. Testing for leakage is accomplished by measuring the drop in pressure after the space to be tested for leaks is filled with air at a higher-than-atmospheric pressure. The equipment (Fig. 1) operates on a comparator principle in which the castings to be tested are checked against standard master parts. The principle of operation is first to pressurize the cavity of the casting and then measure the difference between the original "fill" pressure and its lowered value if a leak in the wall of the casting is present. The amount of the pressure-drop within an established test time becomes a direct measurement of the magnitude of the leak. Air is supplied through a pressure regulator to the casting to be tested and to both sides of the differential pressure transmitter. An electric timer closes solenoid valve A, isolating the



filling pressure in the high-pressure side of the transmitter and commencing the test period. Any leak results in a drop of pressure and is transmitted to the receiver gauge and to the precision relay. After a predetermined test time, solenoid valve B closes. If the pressure drop is greater than the permissible amount, the casting on test is rejected. The complete apparatus is furnished on a factory-tested cabinet, the dimensions of which are 36 by 24 by 12 in. The weight is approximately 200 lb. and all the equipment operates on 240 volts 50 cycles a.c. electricity supply.

Miniature Tipper

A range of miniature power-operated tipping vehicles has been introduced by the Mercury Truck & Tractor Company, Limited, of 19, London Road, Gloucester. The vehicles, claimed to be both compact and sturdy, are built to special heavy-duty specifications, and are capable of handling large quantities of material in confined spaces with minimum labour. The smallest vehicle in the range has an overall width of 3 ft. 10 in. and carries and tips a full load of 1 ton or 30 cub. ft. This 1-ton model is petrol driven, and 2-ton petrol and diesel models, with overall widths of 4 ft. 5 in. and 4 ft. 8 in. respectively, complete the range. Although specially built for quick, easy handling of bulk materials the tippers can be used for many other types of foundry loads. All operations are controlled from the driver's seat, and power-operated hydraulic tipping-gear gives finger-tip control of body-movement to any angle up to 45 deg. Tipping can be either side, end or three-way as required.

Fire Extinguisher

A new pressure-operated dry-chemical fire extinguisher which weighs less than 10-lb. when fully charged, is now being marketed by the Pyrene Company, Limited, of 9, Grosvenor Gardens, London, S.W.1. It has been designed to meet the need for a small, yet powerful fire smothering unit to deal with outbreaks involving petrol, oils, paints, spirits, solvents, greases, etc. It can also be used with safety on fires involving electrical equipment. Charged with 5-lbs. of dry chemical powder, the extinguisher is pressurized with nitrogen up to 150-lb. per sq. inch, although it will still operate satisfactorily at pressures as low as 100-lb.

FIG. 1.—*Diagrammatic layout of the leak-test set-up, for checking the air-tightness of hollow castings.*

SUPERSLOT ANGLE COMPANY (G.B.), LIMITED, Broadway Chambers, 40, Broadway, London, S.W.1, announce the addition of two new items to their range of slotted, angle material for constructional purposes. One is made from 10 gauge by 1½ by 1½ in., in hot-rolled steel and is well suited for building construction. The second, known as Superslot "Minor," is of 14-gauge and is useful for racks and shelves.

A NEW SUBSIDIARY, Head Wrightson Colliery Engineering, Limited, has been formed by Head, Wrightson & Company, Limited, which last April announced the purchase of Colliery Engineering, Limited, Sheffield.

A SCHEME first proposed two years ago to provide a new deep-water berth at Newcastle Quay estimated to cost about £750,000 is to be proceeded with by Newcastle-upon-Tyne Corporation Trade and Commerce Committee.

THE PORTABLE ELECTRIC TOOL MANUFACTURERS' ASSOCIATION announce that the annual conference of European electric-tool manufacturers—being held for the first time in Britain—opens in London on June 27. Delegates from most European countries are expected. The British manufacturers sponsoring the conference are Consolidated Pneumatic Tool Company, Limited, Desoutter Bros., Limited, Kango Electric Hammers, Limited, and Wolf Electric Tools, Limited.

Bridging the Gap

Owing to the unfortunate break in publication of the JOURNAL due to the dispute in the printing trade, happenings in the foundry industry have not been reported week by week in these columns, as is usual. It is felt that some endeavour should be made to record briefly what has transpired so that readers may be informed of the news arising in the meantime. The following paragraphs have, therefore, been prepared in an attempt to "bridge the gap" without causing mental indigestion.

Social Events and Long-service Awards

The spring of the year usually brings in its train a host of social events and this year has been no exception in the foundry and related industries. For instance there has been the annual ball organized by the sports and social committee of the ROLLS-ROYCE oil-engine division at the Churchill Hall, Derby, which attracted 450 employees. Another well-attended function was the dinner of the Student Association of the BRITISH ELECTRICAL ENGINEERING COMPANY, LIMITED, held at the Kings Head Hotel, Loughborough. N. HINGLEY & SONS, Netherton, entertained to dinner their "veterans of industry club"—those with over 40 years' service. The quota of gold-watch distributions for long service included those to nine employees of HALE & HALE TIPTON, LIMITED. Employees again collected the honours when members of the darts club of ALFRED ELLISON, LIMITED, Perry Barr, Birmingham, once more carried off the local league championship and all five cups for which they could compete. The centenary of the formation of the firm was celebrated by ARCHIBALD & SONS of Bo'ness, who distributed approximately £1,000 in sums of £4 to £10 to present and past employees. Another 100-year celebration will be that of CHARLES ROBERTS & COMPANY, LIMITED, Horbury Junction, who this year will distribute £20,000 amongst their employees. This firm is to further perpetuate the memory of its founder by changing the name of the street adjoining their works to Charles Roberts Street.

Viewpoints and Opinions

At the several business gatherings held during the last few weeks, the range of subjects discussed has been wide and various, but some of the comment is pertinent to the makers of castings. The Government's latest economic measures were dealt with at the annual luncheon of the Federation of British Industries, by Sir NORMAN KIPPING, director general, who said he felt no undue concern over the effects these measures were having on industry. The reduction in demand, as their effects filtered through to the supplying industries, would release manpower, the scarcest commodity of all. Both industry and the Government needed to keep a close watch on the situation to see how right the judgment had been with regard to the restrictions imposed. Previously, when presenting prizes at Wolverhampton Technical High School, Sir Norman had expressed the opinion that the world depended for improved standards of living upon scientific and technical leadership. The headmaster of the school, Mr. BRINSLEY EDWARDS, said that the response of Britain's industrial rivals to this technical age of nuclear fission, electronics and automation, on the educational side, was more determinedly practical than our own. A similar view was expressed by Mr. C. O. OLD, principal of the Wolverhampton and Staffordshire Technical College, who said that during a recent visit to Germany, he had been most impressed by the thoroughness with which the German engineering industry was tackling its apprentice problem. He was speaking at a meeting of local industrialists in Wolverhampton the outcome of which is that a group apprenticeship scheme is to be organized in the town. Mr. Old promised the services of the College to any apprentice-training scheme launched in Wolverhampton.

That it was essential for the British businessman's viewpoint to be put forward in international discussions was the opinion of Mr. C. A. G. SAVIDGE, director of the British National Committee of the International Chamber of Commerce, when he addressed the Birmingham Chamber of Commerce Council. He said that unless we were in a position to hold our own in these discussions, the American element would undoubtedly come to the fore and would be looked upon for the leadership of the international and industrial world. The predominance of America in the Canadian market was referred to by Lord ROCHDALE, president of the National Union of Manufacturers, when he addressed the Birmingham Rotary Club. He said our export trade with Canada during the past 12 months had been disappointing. Canadian purchases from this country amounted to only 9½ per cent. whilst those from America amounted to 72 per cent. Considering the deficit which Canada had with the U.S.A. it should be easy for Britain to switch a small percentage of those purchases from the U.S. to this country. Canada was an expanding market and one in which we must go in to stay.

Extensions and Expansions

News received over the last few weeks of extensions and expansion in the foundry industry includes the reports of plans for an extension to the brass foundry of F. SMITHSON, at Anchor Mills, Watergate, Dewsbury, Yorks; for the erection of a light foundry by FRY'S METAL FOUNDRIES, LIMITED, at London Road, Glasgow, E.2; extensions to the works of F. A. NORRIS & COMPANY, LIMITED, at Garth Road, Morden, Surrey and PARK FOUNDRY COMPANY, LIMITED, has also had plans drawn up for the erection of a new foundry building in Park Road, Chesterfield. The managing director of POLLARD BEARINGS, LIMITED, Ferrybridge, Yorkshire, has visited Canada to inspect a site at Oakville, Toronto, for a new factory for the company; a shell-moulding research and development centre has been established by the SHALLWAY CORPORATION, in Conneville, U.S.A., BORER'S LIMITED, of St. Albans, is to build a new factory at Bothwell Road, Hamilton, nr. Glasgow, and W. & T. AVERY, LIMITED, are erecting a new showroom and service workshop in Birmingham Road, West Bromwich. A major furnace-rebuilding programme has been completed in the Templeborough melting shop of STEEL, PEECH & TOZER, Rotherham. Of more general interest was the announcement that a new building, which will provide separate accommodation for teaching fuel technology at Sheffield University, is to be erected in Newcastle Street, Sheffield. Premises, within a short distance of the Birmingham city centre, which have been acquired by the Birmingham and District Industrial Safety Group, are to be adapted for use as a new training centre. It was also reported that construction work was in its final stages at the new 130,000 sq. ft. factory on the Thornliebank Industrial Estate, Glasgow, for the shaver division of Remington Rand, Limited: English Steel Corporation, Limited, have received approval for the first stage of the development of the area at Tinsley Park, Sheffield. This site was acquired by the company in 1954, so that an adequate area would be available for the development of heavy industries.

Bridging the Gap

Contracts Placed

Negotiations abroad have resulted in orders for:—GUY MOTORS, LIMITED, of Wolverhampton, and its associate, the SUNBEAM TROLLEYBUS COMPANY, LIMITED, to supply buses and trolleybuses for Johannesburg, to the value of approximately £300,000. British motor cycles for the Canadian Forces have been ordered from the TRIUMPH ENGINEERING COMPANY, LIMITED, Coventry, to the tune of one million dollars, CHAMBERLAIN INDUSTRIES, LIMITED, of Staffa Works, Leyton, are to supply a further shipment of three standard-type petrol driven cranes for the Egyptian Air Force, and the FRASER & CHALMERS ENGINEERING WORKS of the GENERAL ELECTRIC COMPANY, LIMITED, has received an order for an ore-handling and preparation plant for the AUSTRALIAN IRON & STEEL COMPANY, LIMITED. "Home" orders include the supplying of high-pressure pipework and valves for the Willington "A" power station by AITON & COMPANY, LIMITED, Derby, a passenger-cargo motor-ship by HARLAND & WOLFF, LIMITED, for the British Phosphate Commissioners, London and Australia, 100 20-ton bulk grain vans for the British Transport Commission by the PRESSED STEEL COMPANY, LIMITED, and VICKERS-ARMSTRONGS (ENGINEERS), LIMITED, Barrow-in-Furness, have received an order from SULZER BROS. (LONDON), LIMITED, for 30 diesel-traction engines.

Agreements and Negotiations

The agreements and negotiations which have been announced are as follow: HEPPENSTALL COMPANY, of Pittsburg, U.S.A., manufacturers of die-blocks have entered into an agreement with WILLIAM JESSOP & SONS, LIMITED, of Sheffield, whereby Jessops will manufacture Hardtem die-blocks in the U.K.; TECALEMIT, LIMITED, Plymouth, announce negotiations for manufacturing arrangements for their lubrication equipment in India to meet that country's expanding needs; FOUNDRY EQUIPMENT, LIMITED, of Leighton Buzzard, Beds, have taken over the manufacture, sale and servicing of all magnetic moulding machines, hitherto manufactured by BRITISH INSULATED CALLENDER'S CABLES, LIMITED.

Short-time Working

Many factors have contributed to the decision of a number of firms to resort to either short-time working, or the laying-off of men, over the last month or so. The credit squeeze affects all, but other causes are attributed to the exceptionally severe winter, the closing down of certain overseas markets, the normal seasonal decline, etc. Nevertheless, the firm of GLOW-WORM BOILERS, LIMITED, Milford, Derby, where about 50 employees were said to be working short time, report that orders were actually higher than usual for this time of the year, and although DAVID BROWN INDUSTRIES, LIMITED (tractor division), Meltham, resorted to a four-day week in some departments, it was expected to be for a short time only, and it was stressed that business prospects were good and plans for the new 2D tractor were in no way affected. At the Smethwick works of DARTMOUTH AUTO CASTINGS 60 men were declared redundant; between 70 and 80 employees were laid off by the HERCULES CYCLE COMPANY, LIMITED, Birmingham, due to a reduction in exports to East Africa, and ARIEL MOTORS, LIMITED, were introducing progressive redundancy to reduce output, which it was expected will affect about 100 men.

Miscellanea

To complete the "bridging of the gap" in the reporting of activities in the foundry industry (and kindred trades) the following by no means complete compilation of facts, figures, and events has been made. In the home industry, the foundry of JOHN TAYLOR & COMPANY, Loughborough, has been engaged in the casting of nine bronze bells which are to be erected in St. Paul's Roman Catholic church in Los Angeles; then the RUBERY OWEN COMPANY, LIMITED, of Darlaston, is in the news with the announcement of the installation of a new press which is claimed to be the largest of its kind in Great Britain. Of 3,000 ton capacity, it will deal with members up to 32-ft. long for commercial vehicles, buses and coaches. A new tool—the Plowcast—for planing cast iron under conditions of heavy, interrupted cutting, has been developed by EDGAR ALLEN & COMPANY, LIMITED, Sheffield, and from BRUCE PEEBLES, LIMITED, the Edinburgh engineering firm, comes the announcement that they have entered the field of electronics, and are forming the nucleus of a research team in this subject. According to an American report, the value of the production from American foundries in 1953 was about £2,250,000,000, covering 17 million short tons of all types of casting; and the output of iron castings in Italy last year at 610,000 *tonnes*, showed an increase of 10,000 *tonnes* over 1954. On the financial side, TUBE INVESTMENTS, LIMITED, have acquired from the Iron and Steel Holding and Realisation Agency, the whole of the issued capital of the PARK GATE IRON & STEEL COMPANY, LIMITED, of Rotherham. Of the price of £5,600,000, £1,000,000 was paid on completion and the balance is to be paid within two years. The Copper Mining Companies of the RHODESIAN SELECTION TRUST GROUP, in conjunction with those of the ANGLO-AMERICAN GROUP, have agreed to lend a total of £20,000,000 to the CENTRAL AFRICAN FEDERAL GOVERNMENT for use in essential development projects. KOPPEL ENGINEERING, LIMITED, Johannesburg, have been appointed by the HEPBURN CONVEYOR COMPANY, LIMITED, as agents in South Africa for the sale of foundry, general conveyoring, and engineering equipment. The AUSTIN MOTOR COMPANY, LIMITED, has been engaged in arrangements for the reopening of the Phillipine market which has been closed to British manufacturers for many years by high tariffs. Parts of cars and light commercial vehicles are to be sent there to be assembled and distributed by FABAR INCORPORATED of Manilla. An annual award for industrial safety efforts has been instituted, the trophy, a Georgian inkstand and a vellum book in which winners names will be inscribed, has been presented by SIR GEORGE EARLE, chairman of the ASSOCIATED PORTLAND CEMENT MANUFACTURERS. THE NON-FERROUS CLUB held its first annual general meeting at the Queen's Hotel, Birmingham, in March, when the sum of the eleven collections taken at the Club's luncheon meetings for the various charities was announced as being £143 13s. 0d. A further collection which was taken at the dinner preceding the meeting realized £23.

MEMORIAL FIGURES of Matthew Boulton, James Watt and William Murdock, of Soho Foundry fame, have been placed on a temporary site in front of the College of Commerce, Birmingham. The statues, the work of the sculptor Mr. William Bloye, are finished in double gold lead. They were cast in bronze by John Galazia and Son, of London. The cost of the statues, which make a fine trilogy, has been borne partly as a result of a gift made by the late Mr. Richard Wheatley, a leather goods manufacturer, of Birmingham, and partly by Birmingham Corporation. The present site is being used because the Birmingham Civic Centre site for which the statues are ultimately destined, will not be available until 1968.

£1¼ Million Contract for G. & J. Weir

G. & J. Weir, Limited, Glasgow engineers, have secured a contract from the Executive Council of the Island Territory of Aruba, Netherlands Antilles, through Singmaster & Breyer, consulting engineers, of 420, Lexington Avenue, New York, for one of the largest sea-water evaporating and distilling plants in the world. This export order, worth about £1,250,000, was obtained in the face of intense international competition from 15 other firms in Britain, America, Germany, Italy and France, and is for installation at Aruba, Netherlands Antilles, of sea-water evaporating plant to provide eight thousand tons (1,792,000 gals.) of fresh water a day. Not only is this the largest individual contract ever received by Weir's, but, it is claimed, the plant when completed in 1958 will be one of the largest in the world.

During the past 30 years Weir's have installed a number of smaller plants in this island, each with an output of 300 tons a day, but increasing local demands now call for a much greater supply. The new plant will comprise four sextuple-effect horizontal evaporating units, each with its own inter-stage pre-heaters, distilling condenser and pumps, and each unit will have a daily output of 2,000 tons of fresh water. A fifth similar unit may be ordered within the next six months from Weir's. Steam, bled from the turbines of the electrical power-generating station, will be supplied to the heating coils of the first stage of each evaporator unit at a pressure of 30 lb./sq. in. g. and special provision is being made by Weir's to prevent scale formation on the coils and inside surface of the evaporators. This will allow the plant to maintain the full rate of heat transfer, saving fuel and avoiding closing down the units for scale removal.

Among recent large orders received by Weir's for sea-water distilling plant, are two for the Lobitos oil fields in Peru, to supply 270 and 500 tons of fresh water daily. The first of these, occupying a complete special train, has just been despatched to Liverpool for shipment. Another installation has just been completed at Kuwait in the Persian Gulf, and is producing a million gallons or about 4,500 tons a day for domestic supplies in the town.

Hadfields and Landegger Again

Lord Dudley Gordon, chairman of Hadfields, Limited, steelfounders, machinery makers, etc., of Sheffield, states in a circular to shareholders that he has been approached by Mr. Karl F. Landegger (who recently failed in an attempt to secure control of Millspaugh, Limited) with a view to his election to the board. Mr. Landegger claims that he and his associates now hold more than 20 per cent. of Hadfields issued capital. He also asks for the election of Mr. R. A. Clark, a solicitor, who it is understood, is advising him. Lord Dudley Gordon states that he and his colleagues on the board are unable to support these proposals, in view of the highly competitive interests directed by Mr. Landegger—the Black-Clawson Company of America and its United Kingdom subsidiary.

MATTHEWS & YATES, LIMITED, manufacturers of fans and air-conditioning equipment, announce the opening of a new branch office at Jacey House, the Lansdown, Bournemouth, at which Mr. J. R. Barlow, formerly manager of their Birmingham branch, will be in charge.

Course on Sand Control

The next course on sand control by the British Cast Iron Research Association will be held at Alvechurch from Tuesday, April 17, to Friday, April 20, inclusive. The attendance will be limited to a maximum of 12 and applications will be dealt with in rotation. No fee is charged for the course. Should, however, the number of applicants exceed 12 a further course or courses will be held after a short interval.

The scheme was originally designed for young technical men concerned with sand testing and sand control in the foundry, but many senior foundry foremen have also attended. Reports from founders have indicated that the course has been equally useful to foremen and technicians and men from either category are therefore invited. The following is a brief summary of the subjects dealt with: Sand testing; formation of sand deposits—type of deposit found in Britain; properties controlled by the sand grains; properties controlled by the clay bond; natural and synthetic sands; effect of additions such as coal dust, pitch or wood flour; changes which occur in use: how to maintain the properties of a sand system; properties of sands with organic binders: oils, synthetic resins, cereals; miscellaneous binders; properties and testing of sand at high temperatures; effect of ramming densities on the properties of sand and the effect of the method and intensity of ramming on the behaviour of moulds during pouring; casting defects arising from the moulds or cores; and shell moulding.

Proposed New Special Regulations for Fencing Abrasive Wheels

The Minister of Labour and National Service, Mr. Iain Macleod, proposes to make new Special Regulations for the fencing of abrasive wheels in factories and other works covered by the Factories Acts. The proposed Regulations will lay down standards of fencing of abrasive wheels modifying the existing statutory provisions for the secure fencing of dangerous parts of machinery.

The Minister published notices of his proposal in the London and Edinburgh Gazettes on March 27. Copies of the draft Regulations, which are called "The Fencing of Abrasive Wheels Special Regulations, 1956," may be obtained from HM Stationery Office (price 2d.). Any objections to the draft Regulations by or on behalf of persons affected must be sent to the Minister on or before May 7, 1956. Any objection must be in writing and must state the specific grounds of objection and the omissions, additions or modifications asked for. Objections may be addressed to the secretary, Ministry of Labour and National Service, 19, St. James's Square, London, S.W.1.

Important Date Change

The date for the works visit arranged on a country-wide basis for the membership of the Institute of British Foundrymen has been changed from October 5 to October 12. This year, as already reported, the visits will take place in the Manchester area and the Lancashire branch of the Institute will be the hosts.

AT A RECENT MEETING of the West Riding Ironfounders' Association, Charles D. Buckle & Company were confirmed in office as secretaries of the Association. In future all correspondence should be addressed to Mr. S. G. Farley of that company.

Notes from the Branches

Newcastle-upon-Tyne

The Neville Hall was filled to capacity for the meeting of the Newcastle-upon-Tyne branch of the Institute of British Foundrymen, held on February 11. The occasion was a visit by a past-president of the Scottish branch, Mr. W. Y. Buchanan, metallurgist and foundry manager of John Lang & Sons, Limited, who presented a Paper entitled "Cupola Practice." The meeting was opened by Mr. C. Nicholls, branch president, who commented on Mr. Buchanan's work for the Institute and extended him a very hearty welcome.

Development Work

Initially Mr. Buchanan emphasized some of the qualities necessary to understand and work the cupola efficiently, saying much had been written about the cupola, both scientifically and technically, but so many variables were involved that only experience could give a proper understanding of its operation. After long consideration of working an ordinary type of cupola, he had become convinced that, by water-cooling of the bosch, maintenance costs could be reduced and the furnace operated more economically. The decision had then been taken by his firm to instal a water-cooled cupola, and for various reasons it was thought best to design, construct and erect the cupola themselves. Many snags had been encountered, largely due to the position chosen for the erection, where clearances at the roof of the building were almost negligible. Because of this difficulty, parts had been assembled from the top downwards; thus the top part carrying the spark arrester, was made suspended from the roof, the remaining cylindrical parts being located and lifted up to it, the whole giving only about 1-in. clearance from the base section, which had been constructed initially. Stages in the erection of this cupola were shown by lantern slides, as also was the erection of a small cupola for melting turnings and borings.

Performance

Graphs were shown of times and temperatures achieved with the furnace in comparison with the normal design of cupola and approximately similar charges. Mention was made of experiments with oxygen additions and also with oil fuel. An interesting modification to the water-cooled cupola had been the use of preheated air. In this system, the air channel was arranged through the furnace stack, through which it passed before entering the cupola *via* the tuyeres. This provided a warm blast and, although from graphs shown the effect was not noticeable during the first half hour or so, subsequently the temperature of the metal was higher than normally obtained, yet with a reduced fuel charge.

In addition to the cupola, several other interesting features were illustrated, particularly, a method of charging and a chute into which weighed charges were placed when taken from the stockyard.

An interesting discussion followed Mr. Buchanan's remarks, and there was confirmation of the value of warm blast for cupola operation. One member reported having made use of this system for several years. A vote of thanks to Mr. Buchanan for his interesting and informative lecture was proposed by Mr. C. W. Stewart and supported unanimously.

Slough

In mid-March, 22 members of the Slough section of the London branch paid visits late one evening to foundries "out-of-the-ordinary." Here they witnessed the casting and processing literally of thousands of castings, some very tiny and some quite large. The explanation is that they were visiting newspaper printing houses in Fleet Street, London, one party touring the "Daily Telegraph" and a second the "Daily Express." The smallest castings were the single type letters, larger ones were represented by lines of type and the largest by the half-drums weighing about 60 lb. each from which a whole page of a newspaper is printed, on the rotary printing presses. The visitors were much impressed by the elaborate organization required in producing a newspaper, which they inspected in all phases from the news receiving room to the despatch of finished copies of the early editions. The "foundry" part was indeed a revelation to the delegation, of just what speed and accuracy can be achieved when high-precision pressure-die-casting is mechanized to the nth degree.

Earlier in the evening, the members had dined together at the "London Club" (in the West End) of Slough Estates, Limited—on the introduction of Mr. J. P. P. Jones, a past-president of the section. Mr. J. Wood took the chair at the dinner. The arrangement of the whole evening's programme, which included travelling by coach out from and return to the Slough area, was in the hands of Mr. P. Hoesli, the section secretary.

West Wales

The West Wales section of the Wales and Monmouth branch held a meeting in Swansea on February 24, when Mr. J. M. Langham, M.A., A.M.I.MECH.E., presented a Paper, "Founding of Marine Propellers," and this was followed by a film showing the making of the propellers for the R.M.S. Queen Elizabeth. In the discussion, members commented on the very clear picture of this specialized branch of foundry work that Mr. Langham had given, together with information on the cement-moulding process. Replying to questions, Mr. Langham stated that: Cement moulding did not create any dust problems that could not be dealt with by conventional dust-control methods; the metal was held in the furnace while a laboratory check was made on composition and microstructure, which took 30 to 35 minutes; he had not used the electric-arc method for keeping feeder heads molten, but thought it to be a good idea. Proposing a vote of thanks, Mr. W. S. G. Rees complimented the lecturer on the excellent presentation of his Paper. Mr. C. Jenkins seconded the proposition, which was carried with approbation.

Australian (Victoria)

The Australian (Victoria) branch of the Institute have completed their lecture programme for 1956. This will include a mid-year round-table conference and a joint meeting with an engineering society at the town of Sale, which is about 150 miles from Melbourne. This meeting will take the form of a works visit and joint lecture.

On Saturday, February 25, the branch participated in a works visit to S. L. Lacy & Sons Pty., Limited. at Sale, jointly with the Gippsland Engineering Society, who acted as hosts. That evening, also, the delegates joined for a Paper, "Man and Metals," by A. M. Tennant. The next day was devoted to a river trip in the morning and return to Melbourne in the afternoon.

News in Brief

THE Cambridge depot of British Insulated Callender's Cables, Limited, now has an additional telephone number—Cambridge 55451.

GRAHAMSTON IRON COMPANY, LIMITED, Falkirk, are to erect a mechanized moulding shop at their works at an estimated cost of £60,000.

S. OSBORN & COMPANY, LIMITED, Wicker, Sheffield, 3, has had plans approved for the erection of a foundry and rolling mills at Holbrook, Chesterfield.

UNDER AN ORDER which came into force on February 13 licences are required for the export to all destinations of all types of alloy and non-alloy iron and steel plate.

THE MANCHESTER OFFICE of Brightside Heating & Engineering Company, Limited, has been housed in new premises from March 26, at 105-107, Princess Street, Manchester, 1; telephone: Central 4377.

WILLIAM JESSOP & COMPANY, LIMITED, makers of special steels, Sheffield, began the production of titanium on a commercial scale during the last week of March. This is the first time the metal has been made on this scale in this country, although fabrication of the metal had been carried on.

THE FIRST 330,000-volt transformers to be built in Britain are to be manufactured by the English Electric Company, Limited, at Stafford, under a contract from the Electricity Commission of New South Wales. The order, worth about £250,000, is for seven 54,000-kva, 330-kv, single-phase transformers.

AT THE INVITATION of the *Societe de Chimie Industrielle*, Paris, the European Federation of Corrosion is to hold its first congress during the convention for chemical engineering which is to take place in connection with the fourth *Salon de la Chimie*, Paris, from November 22 to December 3.

FIRST ISSUE of "Close-Up," house magazine of Armstrong Whitworth (Metal Industries), Limited, and Jarrow Metal Industries, Limited, comes from Close Works, Gateshead-upon-Tyne, and carries news of people and products associated with the two companies. An illustrated article tells of some early experiences in the manufacture of "Closeloy" rolls.

NEARLY 400 EMPLOYEES and friends attended a sports club dance of the Sheepbridge Engineering Company, Limited, which was held in the works canteen. Among those present were Mr. G. E. H. Hall, Mr. R. Gore, and Mr. C. Hand, general managers of Sheepbridge Stokes, Limited, and the engineering, and foundries division of Sheepbridge Equipment, Limited, respectively.

THE NATIONAL INDUSTRIAL SAFETY CONFERENCE, organized by the Royal Society for Prevention of Accidents, will be held in Scarborough from May 11 to 13. Included among the five papers to be presented is "Dust Suppression in Industry," by Mr. W. B. Lawrie; "Education and Training of Entrants to Industry," by R. G. Bellamy; and Mr. C. N. Cruikshank, M.D., will present a paper on "Skin Irritants."

A COMPRESSOR—known locally as "The Thumper"—at the Neepsend gasworks of the Sheffield and Rotherham division of the Gas Board, has been the subject of complaints by local residents who sent petitions to the city council, Gas Board, and their Member of Parliament. Alterations have now been made to the plant in an endeavour to deaden the noise and vibration which was the cause of the complaints.

GEORGE ELLISON, LIMITED, are celebrating their Jubilee this year, and at the Electrical Engineers Exhibition, Olympia, recently, there was on their stand a 1910-vintage star-delta starter, with overcurrent and time-lags with low-voltage release. Actually, the company are attempting to find the oldest gear they have manufactured which is still in service, and will be grateful to hear from old customers about equipment which is at least 40 years old.

AFTER it had been reported to Hull Corporation Central Purchasing Committee that five tenders for the supply of three types of furnace coke for the coming financial year were identical, the committee decided to recommend that the Town Clerk should draw the attention of the Monopolies Commission to the matter. It was agreed that the corporation committees concerned should be recommended to accept all five tenders, and that the contract should be sub-divided between the five concerns on the basis of the coke required.

THE SPRING MEETING of the Institute of Welding will be held in the Eastern Counties this year from May 3 to 5. The programme includes works visits on the Thursday and Friday (May 3 and 4) and technical sessions on the mornings of Friday and Saturday (May 4 and 5). Visitors will be welcome at the technical sessions but places on the visits to the works (which include a number of foundries) are limited and early application for reservations should be made to the secretary of the Institute at 2, Buckingham Palace Gardens, Buckingham Palace Road, London, S.W.1.

APPRENTICES and junior operatives of the United Steel Companies to a total of 130 spent the weekend March 23 to 26 at a conference at Downing College, Cambridge, on the subject of "responsibility." They came from the group's works in Sheffield, Rotherham, Scunthorpe and Workington. Speakers included Lieutenant Commander G. W. Wells, a director of United Steel Companies and a director and general manager of Appleby-Frodingham Steel Company, Scunthorpe; Mr. Kenneth Davis, chairman of the Industrial Welfare Society's executive committee, and Professor Rex Knight, professor of psychology at Aberdeen University.

INDUSTRY IN THIS COUNTRY could learn much from industry in France, declared Mr. W. R. A. Hudson, MP for North Hull, in Hull last month. He said that although prices had remained reasonably stable in France, they had been stabilized at a high level. Yet wages had increased, and the reason for this was that in 1954 production had increased by 9 per cent., and in 1955 it was 10 per cent. better still. Coal production was also rising. The fundamental lesson was that any increase in wages could only come from increased production. In France there were, broadly speaking, no restrictive practices in the unions, and so far as he was aware, few or none anywhere else.

BABCOCK & WILCOX, LIMITED, announce the formation of a materials handling division, which will coordinate in one group the various functions hitherto performed by separate departments. The new division will deal with all types of materials handling, but not with cranes or furnace-charging equipment which will still be the province of the crane department, as at present. The new division will be officially formed

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FS/29

News in Brief

in June, and will be accommodated at Lynton House, Tavistock Square, W.C.1 ('phone EUSTON 4321). The manager of the new division will be Mr. F. S. STENT, at present a director of the Marco Conveyor and Engineering Company, Limited, and Mr. R. A. TAYLOR, hitherto in charge of the conveyor department of Babcock & Wilcox, has been appointed chief technical officer.

DISTINGTON ENGINEERING COMPANY, LIMITED, Workington, Cumberland, a branch of the United Steel Companies, Limited, announced a record production of 1,663 tons of iron castings during the week ending January 28. Previous best output from the Distington iron foundry, which is believed to be the largest single production unit of its kind in the United Kingdom, was 1,560 tons, achieved during the week ending January 14. Deliveries of castings during the last week in January amounted to 1,777 tons, of which about a quarter were exported. Production in this foundry during the last few months has been higher than ever before, and reflects to a large extent the high level of activity in the iron and steel industry, which absorbs the greater part of the foundry's output in the form of ingot moulds, bottom plates and slag ladles.

THE SPRING MEETING of the Institute of Metals will be held in London from April 10 to 13. On the first day Dr. Willis Jackson, F.R.S., of the Metropolitan-Vickers Electrical Company, Limited, will deliver the May lecture on "Ferro-electrics—Dielectric Analogue of Ferromagnetics." On the following morning, Major C. J. P. Ball, D.S.O., M.C., will deliver his presidential address on the "History of Magnesium." The Metallurgical Engineering Committee has arranged an all-day symposium on the "Final Forming and Shaping of Wrought Non-ferrous Metals," and the recently formed Nuclear Energy Committee has arranged a discussion on materials for nuclear power engineering. There will also be discussions on the themes: "Powder Metallurgy"; "Embrittlement and Fracture"; Rolling Textures and Recrystallization"; and "Alloy Thermodynamics."

AT THE ANNUAL BANQUET of the Coventry Chamber of Commerce recently, the Minister of Transport and Civil Aviation, Mr. Harold Watkinson, told local leaders of industry that the era of exhortation was over and the time for concerted action had arrived. Proposing the toast of the Trade and Industry of Coventry, Mr. Watkinson said that the Government was in no doubt that the nation's future prosperity rested entirely on the great industrial areas such as Coventry to increase its share of the world trade against intense foreign competition. Great expansion of the roads programme was only possible if steel were diverted from other important users, the Minister went on. Even a small by-pass road could consume 2,000 to 3,000 tons of steel. He thought he could give the motor manufacturer the best immediate solution by selecting work that would increase traffic flow and ease "bottlenecks." At the same time he was making plans to press on with new motorways and trunk roads.

AUTOMATIC TELEPHONE & ELECTRIC COMPANY, LIMITED—Mr. C. O. Boyse has been elected a director. At the next annual meeting it is proposed to increase the number of directors permitted in the articles from nine to 12 and then to appoint Mr. G. D. Christie and Mr. F. O. Morrel to the board.

Factory Equipment Exhibition

The 1956 Factory Equipment Exhibition is to be held at Earls Court from April 9 to 14 (inclusive). It will be opened by the President of the Board of Trade, the Rt. Hon. G. E. P. Thorneycroft, P.C., M.P., and has the support and active co-operation of many leading trade and industrial associations including the British Productivity Council. Over 250 firms are taking part and the exhibition will occupy some 250,000 sq. ft. of floor space. Particulars of some of the stands are given in the following paragraphs:

A DISPLAY of fuel-economy instruments will be shown by Kelvin & Hughes (Industrial), Limited, 2, Caxton Street, London, S.W.1, at the exhibition. Exhibits will include flue-gas analysis equipment with the econometer, chart recorders and flowmeters; multi-line recorders for use with thermocouples, resistance thermometers, etc., temperature indicators and portable pyrometers.

A LARGE part of the stand of the General Electric Company, Limited (No. H.10) will be devoted to a display of the most up-to-date sound reproduction equipment and telephone systems for industrial use. Other equipment will be shown for space heating, process heating, lighting and ventilation in factories and offices. Among these exhibits there will be a number of items of new equipment, including Osram lamps and tubes and a room air conditioner.

TO DEMONSTRATE the part gas can play in a factory the Gas Council are featuring at the Factory Equipment Exhibition (stand No. J.21) an "on-the-spot" repair and maintenance shop. Equipment will include a brazing hearth; a small oven furnace for general heat-treatment; a furnace for hardening and tempering; a pipe and bar bender; and, of interest to pattern-makers, a soldering-iron heater. Demonstrations by means of models will show how gas is harnessed for high- or low-temperature radiant-heat processing in various industries; and two new types of gas-fired box-ovens fitted with explosion-relief will also be on show.

WOLF ELECTRIC TOOLS, LIMITED (stand No. E.15) will have a complete range of industrial and home-craftsman portable electric tools on view. Industrial tools will include drills, heavy-duty 6- and 8-in. bench grinders, 4- and 6-in. portable grinders, rotary and belt sanders, and a new belt-sanding attachment designed for use in conjunction with the firm's 6-in. high-speed heavy-duty grinder, type GQ.6. It consists of a 4-in. dia. by 2-in. wide rubber-tyred contact wheel and a cast-aluminium bracket, at the end of which is mounted a steel jockey-pulley running on a ball bearing. A 24-in. by 2-in. endless belt is fitted.

UNDER the general title of "Oil Fuel in Industry," a display has been designed to demonstrate that the British oil-burner industry accepts the challenge to bridge the energy gap caused by Britain's expanding industrial demands for heat and power outstripping its internal fuel resources. More than 70 manufacturers are participating, and equipment on view will range from oil-fired air heaters and boilers for heating factories of 1,500 sq. ft. of floor space and upwards, and include oil-firing equipment for boilers generating up to 50,000 lb. of steam per hour. There will be fully-automatic burners on show, oil-fired central heating boilers, a battery of industrial-furnace burners, and a "live" display of radiant space heating.

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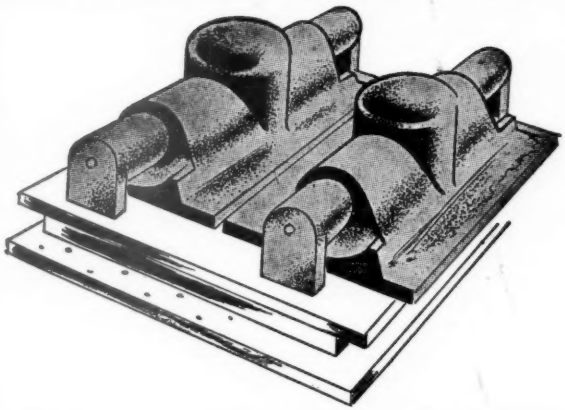

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Personal

Mr. REGINALD S. MEDLOCK, B.SC., has been appointed to the board of George Kent, Limited, Luton, Beds.

The new Sheriff of Derbyshire is MAJOR FRANCIS DOUGLAS LEY, managing director of Ley's Malleable Castings Company, Limited, Derby.

MR. ERNEST C. RUFFLE, who recently retired from Wellworthy, Limited, has joined the board of Toledo Woodhead Springs, Limited, Sheffield.

At a recent meeting of the Council of the British Plastics Federation, Mr. C. C. LAST, a director of Bakelite, Limited, was appointed chairman of the Federation.

Mr. A. J. SHAW, a moulder employed for 42 years at the works of Arthur Green, Limited, Old Whittington, Chesterfield, has been presented with a gold watch in recognition of his service.

The services of Sir HAROLD SPENCER JONES, K.B.E., F.R.S., who recently retired from the position of Astronomer Royal, have been retained in a consultancy capacity by the Smiths Group of companies.

Mr. T. LAND, managing director of Land Pyrometers, Limited, Sheffield, personally presented a paper on "Suction Pyrometry" to the Instrument Society of America at a congress held in Pittsburg on March 5 to 7.

Mr. J. A. SHAW, a director of John Shaw & Sons (Honley), Limited, ruling machines, Honley, is to be nominated as prospective Conservative candidate for the Lockwood Ward in the forthcoming Huddersfield Municipal elections.

Sir ERIC CARPENTER, president of the Association of British Chambers of Commerce and a member of the Dollar Exports Council, was the principal guest at the centenary banquet of the Wolverhampton Chamber of Commerce on March 27.

Sir GEOFFREY VICKERS, V.C., who was legal adviser to the NCB from 1945 to 1948, and Mr. GEORGE J. CUTBUSH, director and works manager of the Metropolitan Leather Company, Blackburn, have been elected directors of Parkinson & Cowans, Limited, manufacturers of meters, and gas, electric, water and oil appliances.

After an association of 33 years with the firm of Brookes (Oldbury), Limited, Mr. G. H. MERCER, managing director, has retired. Mr. Mercer joined the concern when trade was depressed and mainly because of his enthusiasm and foresight the business flourished. To mark his retirement he has been presented with an inscribed barometer.

Mr. EDWIN TASKER, a director of Darby & Company (Birmingham), Limited, and associated companies, completed 50 years' service with the group on March 26. Apart from being still engaged in active direction, he shares in the work of various trade associations in the foundry and iron and steel industries. At an anniversary dinner he was presented with binoculars from his co-directors and an easy-chair from the staff.

Mr. ROBERT GREER, managing director of John G. Kincaid & Company, Limited, marine engineers, Greenock, has completed 60 years of service with the company. He was closely associated with the late Mr. John G. Kincaid and the late Mr. James S. Kincaid, and now with Mr. Randal G. Kincaid, the present chairman, in the development of the company. He has been presented with a gold watch from his co-directors by Mr. Kincaid.

Mr. MALCOLM EASTON has retired after 40 years' service with the Burton Foundry Company, Burton. He joined the firm as a foreman patternmaker in 1915. To mark the occasion he was presented with a cheque by Mr. F. R. Martin, general manager, representing both the Allied Ironfounders, Limited, and the Burton Foundry Company. The gift was from the executives and supervisory staffs. Mr. Easton also received a gift of treasury notes from his colleagues.

Obituary

The death has occurred of Mr. A. N. SPERRYN, a director of Sperryn & Company, Limited.

The death is reported of Mr. ISAAC BIER, founder of I. Bier & Son (Iron & Steel), Limited, London, E.C.2. He was 82 years old.

A foreman at the Burton Foundry Company, Limited, for many years. Mr. WILLIAM J. SIMNETT has died at the age of 53.

The death is announced of Mr. CHARLES KOEHLER, for many years a vice-president of the *Association Technique de Fonderie*.

The death has occurred of Mr. THOMAS BURMAN, chairman of the King's Norton motor-accessory firm of Burman & Sons, Limited. He was 87.

Mr. DOUGLAS A. BOYD, who has died, was a director of J. & T. Boyd, Limited, ironfounders, Shettleston Iron Works, Glasgow, and a graduate in engineering of Glasgow University.

Mr. THOMAS CHARLES HURDLEY, who died at the age of 79, was for more than 50 years chairman of Patent Weldings Company, Limited, of Attercliffe, Sheffield, and chairman of a subsidiary of the company, Sheffield Welders, Limited.

Mr. CHARLES D. BUCKLE, secretary of the West Riding Ironfounders' Association, collapsed and died quite suddenly at his office on February 13. Mr. Buckle attended National Ironfounding Employers' Federation meetings since 1939, when the West Riding Association became affiliated.

Mr. FRANCIS WILLIAM STOKES, managing director of the Sheepbridge-Stokes Centrifugal Castings Company, Chesterfield, and the Stokes Castings Company, Mansfield, died on February 7 at the age of 72. He wrote six Crime Club detective novels under the pen name of Francis Everton. Some were centred on foundry practice and research.

THE DEATH OCCURRED on February 11 of Ald. WILFRID MALLINSON, Mayor of Huddersfield in 1953, at the age of 71. Ald. W. Mallinson was chairman of Henry Brook & Company, Limited, and a former president of the West Riding Ironfounders' Association. He was elected to Huddersfield Town Council as a Liberal in 1940. A keen sportsman, he was a member of the Huddersfield Cricket and Athletic Club, Huddersfield R.U.F.C., and Crosland Heath Golf Club.

The death is reported of MR. T. HARTLEY, director of the British Tyre & Rubber Company, Limited, and general works manager of the BTR group. Mr. Hartley joined the Wood-Milne Company at Leyland in 1913 and shortly after the acquisition of the factory by British Goodrich in 1924 became works accountant. He was later promoted to works superintendent, which position he held until 1951. In that year he was appointed general works manager of the BTR Group, and was elected to the board of the parent company in 1955.

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Raw Material Markets

Iron and Steel

One or two events in recent weeks have tended to cast a shadow over the bright prospects for the iron and steel trade, which have been enhanced by record outputs. Short-time working in the motor industry has caused some apprehension among the foundries catering for it and a further rise in costs is the subject of some speculation in view of the increase of 10s. a week in wages granted to a considerable proportion of iron and steel workers and the threat of an increase in freight rates. There will probably be a limit to the amount of these costs which the industry will be able to absorb.

The stringent position in regard to the supply of low- and medium-phosphorus irons at last shows a sign of easing as a result of improved production, but outputs are readily absorbed. Hematite makers are still committed for some time ahead. The engineering and speciality foundries continue to enjoy a strong demand for their products and consequently maintain a regular demand for all suitable grades of pig-iron. It appears that foundries catering for the motor trade have not met with any cancellation of orders, although at one stage deliveries were required at a slower rate. Even this had its advantages in that the foundries were able to clear orders to other users which had been falling behindhand.

A slight improvement is discernible in the light-castings trade, which has been in the doldrums recently. Not many weeks ago it was difficult even to maintain short-time working, mainly as a result of the falling off in the domestic-utensil trade because of credit restrictions and a slackening call for builders' castings. Many light foundries have relieved their distress by turning to other, more profitable lines and the weather has been favourable to outdoor work, leading to a welcome increase in the call for builders' castings.

There has been no difficulty in obtaining materials. Foundry coke has been meeting consumption adequately and ganister, limestone, and firebricks are forthcoming according to schedule. The demand for scrap is keen, particularly for the better and heavier grades.

Non-ferrous Metals

Copper, which had advanced to a peak point in London of £437 per ton and 55 cents per lb. in the U.S., slumped sharply last week to below the £400 per ton mark. Indeed, market opinion is that the price will continue to trend downwards and settle—for a time at any rate—to around £370-£375 per ton. The steep decline to a more economic price level was due to the unexpected but welcome change in the U.S. producers' pricing and marketing arrangements which are now based on the London Metal Exchange quotations. Apart from the significant boost in status to the L.M.E., which now quotes the accepted world price, the new arrangement means that Chilean copper will now flow to the United States in quantity, thereby relieving pressure on supplies and eliminating the uncertainty of the disposal of that country's considerable copper production. Coming as it did at a time when the return of confidence in the U.S. business outlook has not yet penetrated so pervadingly into the United Kingdom or on the Continent and when the cumulative effects of the sterner monetary measures were manifesting themselves in all directions, a price slide was inevitable. In fact, U.K. consumer supplies, though still small, are in better shape than they have been for some time and demand from the Continent is patchy.

These conditions reflect alike the uncertain economic climate and the critical review of buying policies undertaken by consumers, some of whom have been running down their inventories of wire bars by re-selling to the market. For all that, demand in America is still strong and likely to remain so. But, given a period free from labour strikes, it is generally believed that supply and demand will be in balance in a few months. Moreover, increased production from new mines is expected to swell total production this year. Meanwhile, the R.S.T. price, raised £25 to £385 per ton at the end of February, is not much below the L.M.E. quotation and may well stand above it shortly.

In any event a lower price for copper will be welcomed in many quarters as the growth of aluminium and plastics as substitutes for the red metal (because of the great price differential) has been considerable. However, last week some of the attractiveness of aluminium disappeared as the U.S. and Canadian producers raised their prices by £12 and £10 per ton respectively so that the U.K. price for standard aluminium pig and ingot now stands at £189 per ton. Looking further ahead it is worth stating that with the long-term outlook for aluminium assured and with an acute shortage of hydro-electric facilities, greater resort to coal might provide the answer for aluminium expansion plans, in which case the price will be driven up much higher than at present.

Lead and zinc over the past month or so have been relatively stable markets, the price of lead hovering around the £120 per ton level and that of zinc around the £100 per ton mark. The worst of the automobile crisis in the U.S. is now believed to be over and end-year production figures will, it is believed, look much better than it was thought possible a short while ago. The off-take in zinc has been helped by increased demand from the steel mills. Anyway, so long as the U.S. Government is prepared to continue its price support policy for both metals there is little prospect of the price receding from present levels.

Tin has been a wildly fluctuating market over the past few weeks, the quotation going as high as £900 per ton at one time. This market is riddled with uncertainty over whether the U.S. will close the Texas smelter in the near future and whether Indonesia will deposit the instrument of ratification of the international tin agreement. Until these two questions are settled stability is impossible. Lately, the market has looked steadier due to the re-entry into the market of American buyers.

Official metal prices yesterday (Wednesday) were:—

COPPER, Standard—*Cash:* £397 to £397 10s. *Three Months:* £392 to £392 10s.

TIN, Standard—*Cash:* £772 to £773. *Three Months:* £765 to £766.

LEAD—*First half April:* £120 to £120 5s. *First half July:* £118 10s. to £118 15s.

ZINC—*First half April:* £98 15s. to £99. *First half July:* £97 to £97 5s.

THE MINIBITION, "an exhibition in a nutshell," is now firmly established as an annual event. The seventh in the series will be held concurrently with the national conference of the Purchasing Officers Association at the Spa, Scarborough, from September 27 to 29 inclusive, and space may now be reserved by application to the secretary of the Association at Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4.